Post-Doctoral Research Visit F/M Simulation of hospital activities realized with/without exoskeletons to guide the selection of exoskeletons to assist the medical staff

Contract type: Fixed-term contract
Level of qualifications required: PhD or equivalent
Fonction: Post-Doctoral Research Visit

Context

The team LARSEN has been collaborating with the Hospital of Nancy for deploying assistive robotics technologies to help the medical staff in different hospital departments. In the project ExoTurn (https://members.loria.fr/Sivaldi/projets/exoturn-2020/) 4 exo-skeletons were deployed in the Intensive Care Unit to assist the medical staff in the prone positioning maneuver of COVID patients. The medical staff is eager to adopt new solutions to assist the medical staff in other activities and departments, where the ergonomic conditions of some workstations are difficult. For this reason, the team has now launched the project ExoSim, to help identifying the activities that can be assisted with exoskeletons.

The aim of this project is to develop a new digital tool development program to:

1) help the hospital to identify existing exoskeletons that would be potentially relevant to help hospital staff, and, failing that, to determine the specifications of a new exoskeleton to be acquired or built, through a physical simulation software of the virtual human and ergonomic evaluation developed by Inria/Loria,

2) to provide the hospital with digital instruments integrating subjective evaluation (by questionnaires) and objective evaluation (by wearable sensors) to monitor the experimental exoskeleton test campaign over the short/medium/long term, using this data to guide the exoskeleton adoption process.

The software of this project builds on a digital human model, a physical simulation software and several ergonomics assessment tools that the team has developed in the last years. There may be modifications needed to simulate the effects of the exoskeletons, depending on those that are selected in the process.

Assignment

The objectives of this postdoc are:

* To develop further the physical simulation software of the virtual human and its tools for ergonomics assessment, to evaluate the impact of exoskeletons. Add new exoskeletons in the simulation.
* To record some activities of the medical staff performed in the hospital, using wearable sensors (Xsens, EMG, ECG) that are in the team. This step will be performed in collaboration with ergonomics experts and personnel of the Hospital.
* To evaluate the impact of exoskeletons on the activities recorded in the hospital.
* To help selecting candidate exoskeletons to acquire in the team and test in the lab before testing in the hospital.
* To collaborate with the hospital ergonomics team to carry out pilot studies to evaluate the acquired exoskeletons in test campaigns at the hospital premises.

While the majority of the work is about simulating humans and exoskeletons, and further developing this software, being able to collaborate with the hospital staff is primordial for the success of this project.

The applicant must have strong knowledge of robotics, in particular exoskeletons (dynamics of exoskeletons and human/humanoids, whole-body control), as well as strong C++ skills (the digital human simulation and exoskeleton simulation is programmed in C++ and real-time performance is required). Alternatively, a strong knowledge of biomechanics simulation and control of active exo-skeletons.
This postdoc will work with Serena Ivaldi, Pauline Maurice and Jean-Baptiste Mouret.

References:

Main activities
Write code to perform experiments with robot
Write code to simulate the exoskeleton assisting the human body
Write software documentation
Perform experiments in simulation
Conduct experiments in the real environment
Collect human motion data
Collaborate with the hospital staff in the different departments (logistics, restoration, sanitation, hospitalisation, etc.)
Ensure tight collaboration between the Hospital of Nancy and the team Larsen in Inria / Lo-ria
Perform experiments with real robots: Talos, Tiago, iCub
Write scientific articles and reports
Participate to the Lorraine University of Excellence events and presentations, when appropriate
Participate to national and European projects events (meetings, hackathons) when appropriate

Skills
Candidates should be expert in at least one of these areas:
• Robotics (kinematics, dynamics)
• Whole-body Control
• Biomechanics
• Machine learning
• Modern C++ programming

Benefits package
• Subsidized meals
• Partial reimbursement of public transport costs
• Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
• Possibility of teleworking (after 6 months of employment) and flexible organization of working hours
• Professional equipment available (videoconferencing, loan of computer equipment, etc.)
• Social, cultural and sports events and activities
• Access to vocational training
• Social security coverage

Remuneration
2788€ gross/month

General Information
Theme/Domain: Robotics and Smart environments
Software Experimental platforms (BAP E)
Town/city: Villers lès Nancy
Inria Center: Centre Inria de l'Université de Lorraine
Starting date: 2023-11-01
Duration of contract: 2 years
Deadline to apply: 2023-10-31
**Contacts**

- **Inria Team**: LARSEN
- **Recruiter**: Ivaldi Serena / serena.ivaldi@inria.fr

**About Inria**

Inria is the French national research institute dedicated to digital science and technology. It employs 2,600 people. Its 200 agile project teams, generally run jointly with academic partners, include more than 3,500 scientists and engineers working to meet the challenges of digital technology, often at the interface with other disciplines. The Institute also employs numerous talents in over forty different professions. 900 research support staff contribute to the preparation and development of scientific and entrepreneurial projects that have a worldwide impact.

**The keys to success**

The ideal candidate likes mixing theoretical ideas with real experiments.
The ideal candidate has a background in dynamics simulation of humans, exoskeletons and/or humanoid robots, or a direct experience with exoskeletons and assistive devices.
He/She loves robots, and especially humanoids.
He/She loves exoskeletons.
The ideal candidate likes or is willing to collaborate with medical staff and is eager to contribute to bringing robotics innovations in the hospital.
The ideal candidate has a career plan that involves one of these options: a permanent researcher or professorship in the area of assistive robotics to be developed in our team; or, a startup around exoskeletons for the healthcare sector; or, providing expert services to hospitals in the area of assistive devices and exoskeletons.
Knowledge of the French language is a plus, but not a requirement.

**Warning**: you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.

**Instruction to apply**

**Defence Security**: This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST). Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

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