



Offre n°2025-08861

PhD Position F/M Digital Tools for accompaniment of people with disabilities for sport activities

Type de contrat : Fixed-term contract

Niveau de diplôme exigé : Graduate degree or equivalent

Fonction : PhD Position

A propos du centre ou de la direction fonctionnelle

The Inria Centre at the University of Rennes is one of Inria's nine centres and is home to more than thirty research teams. It is a major and well-recognized player in the field of digital science. The centre is at the heart of a rich ecosystem of R&D and innovation, involving highly innovative SMEs, large industrial groups, competitiveness clusters, research and higher education institutions, excellence laboratories, and a technological research institute.

Contexte et atouts du poste

Sport plays an important role in the well-being of individuals: it is known to improve the self-esteem and the autonomy of people with disabilities, as well as the social inclusion [1]. Practicing sport has also a positive impact on rehabilitation and motivation. The Paris 2024 Paralympic Games have called for a revolution for parasport. Beyond the event, we must now focus on strengthening and promoting the practice of sport by people with disabilities at all levels.

The proposed PhD aims then to offer technological tools to improve performances of users of power wheelchairs: analysis of sessions, training aid, rehabilitation tools through sport. To this aim, we propose to design solutions compatible with the virtual reality power wheelchair simulator developed at INSA Rennes as part of the

European Interreg ADAPT project. Simulators have already been proven to be efficient in the context of rehabilitation [2] [3] and we want to extend the study of the possibilities offered by these platforms to sport situations. The targeted use case is the powerchair football. The team in Rennes expressed the need to help the players to better take benefit of this sport.

The PhD work will rely on specification work led by our biomedical engineer. For the validation step, the PhD student will cooperate with clinicians of Pole Saint Héliér.

Concretly, the work will focus on two use cases. The first one is to provide an augmented reality feedback tool that considers the disabilities of each player to be able to replay game sequences for the analysis and improvement of individual performances. The PhD student will have to tackle the issue of tracking several of them, detecting players, ball and equipment. The first one is about beginners. As a specific powered wheelchair is used, it is tiring, discouraging in the worst case, to play efficiently when beginning. This will be addressed by a virtual reality scenario using a simulator. The PhD student will extend previous work [4] on everyday motorized wheelchairs to the Strike force model whose behavior is different.

Mission confiée

Mission

Based on the specification work, the PhD student should provide an augmented reality tool to provide feedback of sessions and matches. To permit a reliable and acceptable augmentation, the PhD student will propose a coarse-to-fine approach to estimate the 3D pose of a wheelchair. The key idea is to detect and track in the image the wheelchair, to estimate its 3D bounding box and then refine its pose estimation, similarly to [Chabot17]. It will be challenging since it is a very dynamic vehicle, with no texture. Robustness to personalized medical equipment must be tackled. This task will be reinforced with the dynamic modelling of the wheelchair behavior.

Collaboration

The thesis will be conducted within a multidisciplinary team combining skills in robotics, image analysis, virtual reality, haptics, mechanics and electronics, and will be based on the recommendations and clinical expertise of the Pôle Saint Héliér. The recruited person will be in close connection with a local team of soccer players with powered wheelchairs (Handisport Rennes Club).

Bibliography

[1] "De la physique à la pratique physique : la promotion du sport chez les personnes en situation de handicap", Lemahieu Laura, Thèse de doctorat dirigée par

[2] "A meta-analysis and systematic literature review of virtual reality rehabilitation programs", Matt C. Howard, *Computers in Human Behavior*, vol70, pp 317 – 327, 2017

[3] « ViEW, a wheelchair simulator for driving analysis », Y. Morere, G. Bourhis, K. Cosnuau, G. Guilmois, E. Rumilly, and E. Blangy. . In *Assistive Technology* , pages 1–11. Taylor & Francis, 2018

[4] “A generic power wheelchair lumped model in the sagittal plane: towards realistic self-motion perception in a virtual reality simulator” Fabien Grzeskowiak, Ronan Le Breton, Louise Devigne, François Pasteau, Marie Babel, Sylvain Guegan. In *ICRA 2023 - IEEE International Conference on Robotics and Automation*, May 2023, Londres, UK

[5] F. Chabot, M. Chaouch, J. Rabarisoa, C. Teulière and T. Chateau, "Deep edge-color invariant features for 2D/3D car fine-grained classification," *2017 IEEE Intelligent Vehicles Symposium (IV)*, Los Angeles, CA, USA, 2017, pp. 733-738

[6] Fabien Grzeskowiak, Ronan Le Breton, Louise Devigne, François Pasteau, Marie Babel, Sylvain Guegan “A generic power wheelchair lumped model in the sagittal plane: towards realistic self-motion perception in a virtual reality simulator” In *ICRA 2023 - IEEE International Conference on Robotics and Automation*, May 2023, Londres, UK

[7] F. Grzeskowiak, M. Babel, J. Bruneau, J. Pettré. Toward Virtual Reality-based Evaluation of Robot Navigation among People. In *IEEE Conf. on Virtual Reality and 3D User Interfaces, IEEE VR 2020*, Atlanta, United States, Mars 2020.

[8] G. Vailland, Y. Gaffary, L. Devigne, V. Gouranton, B. Arnaldi, M. Babel. Vestibular Feedback on a Virtual Reality Wheelchair Driving Simulator: A Pilot Study . In *ACM/IEEE International Conference on Human-Robot Interaction, HRI 2020*, Cambridge, United Kingdom, Mars 2020.

Principales activités

The PhD student will evaluate the modelling of the dynamics in the simulator to test the impact of training in virtual reality to gain confidence and reduce stress for real sessions. The PhD student will collaborate with players with disabilities, team coaches and clinicians to elaborate training scenarios.

If possible, in addition to the modelling of the dynamics during a game sequence, to provide relevant and realistic scenarios, it is necessary to model impacts between players and impacts between a player and a ball. This requires us to be able to

capture such events and then to model them. Camera embedded onto the wheelchair and motion capture systems will be used to this aim.

The evaluation of the contributions is another challenge. It requires subjective tests taking into account the feedback of the players. To perform experiments with real players, either to collect data, or to evaluate the contributions, it requires the agreement of a committee dedicated to personal protection in research projects (comité de protection des personnes (CPP)). The staff involved in this project is used to work with Pole St Helier, a rehabilitation center located in Rennes, France, to get such agreements.

Compétences

- Master 120 ECTS in intelligent systems, cognitive science, robotics or similar
- C/C++ programming, Matlab, Python
- Interdisciplinary skills

Avantages

- 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

Informations générales

- **Thème/Domaine** : Robotics and Smart environments
Scientific computing (BAP E)
- **Ville** : Rennes
- **Centre Inria** : [Centre Inria de l'Université de Rennes](#)
- **Date de prise de fonction souhaitée** : 2025-10-01
- **Durée de contrat** : 3 years
- **Date limite pour postuler** : 2025-06-29

Contacts

- Équipe Inria : [RAINBOW](#)
- Directeur de thèse :
Babel Marie / Marie.Babel@irisa.fr

A propos d'Inria

Inria est l'institut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 215 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3900 scientifiques pour relever les défis du numérique, souvent à l'interface d'autres disciplines. L'institut fait appel à de nombreux talents dans plus d'une quarantaine de métiers différents. 900 personnels d'appui à la recherche et à l'innovation contribuent à faire émerger et grandir des projets scientifiques ou entrepreneuriaux qui impactent le monde. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 200 start-up. L'institut s'efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

L'essentiel pour réussir

- Capacity to efficiently work in a scientific environment, passion for experimental research, capacity to connect psychology and physical phenomena
- Analytical mind, excellent oral and written communication
- Capacity to conduct independent work within a team
- Excellent level in French and/or English (C1 or equivalent)

Attention: Les candidatures doivent être déposées en ligne sur le site Inria. Le traitement des candidatures adressées par d'autres canaux n'est pas garanti.

Consignes pour postuler

Sécurité défense :

Ce poste est susceptible d'être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L'autorisation d'accès à une zone est délivrée par le chef d'établissement, après avis ministériel favorable, tel que défini dans l'arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un poste affecté dans une ZRR aurait pour conséquence l'annulation du

recrutement.

Politique de recrutement :

Dans le cadre de sa politique diversité, tous les postes Inria sont accessibles aux personnes en situation de handicap.