



Institute of Technology

Ciência sem Fronteiras / Science Without Borders

Postgraduate Project Template

Institution:	Institute of Technology Blanchardstown
Title of Postgraduate Opportunity: (include level of study)	eLearning serious game architecture to support learning of physical skills (such as martial arts, sports and dance) through real-time human motion capture and analysis
PI Name & Contact Details:	Dr. Matt Smith (matt.smith@itb.ie) Dept. Informatics, School of Informatics and Engineering, Institute of Technology Blanchardstown, Dublin 15, Republic of Ireland
Department/School:	Informatics
Research Centre /Group:	Graphics and Gaming Research Group
Research Centre/Group website:	http://www.gamesitb.com/
Brief Summary of PI research / research group /centre activity <p>Dr. Smith has 20 years of research and lecturing experience in computing, artificial intelligence and computer supported learning. He has a PhD in artificial intelligence and music analysis, an MSc in applied artificial intelligence, and a PGCert in education. For the last 5 years he has been focusing on the application of 3D game technologies to support learning. Dr. Smith has a track record of supervising PhD and Masters students to completion, and has published papers in internationally referred conferences and journals. His professional activities include reviewing for the international journal Computers & Education; membership of the computing expert panel for HETAC (the Irish government Higher Educational agency), and is a member of the international expert panel for Agency for Development of Higher Education and Quality Assurance, Bosnia and Herzegovina. Sample publication: Matt Smith (2012) "What computing students can learn by developing their own serious games", Chapter in Ma (ed) <i>Serious Games and Entertainment Applications</i>, Springer-Verlag ISBN: 1447121600</p> <p>The Graphics and Gaming Research Group has successfully supported 7 masters students to completion in graphics and gaming related research degrees. Previous masters and undergraduate and masters projects from students supervised by the group have included mobile phone game language localization, interactive 3D city and building generation, cinematography-based rules for computer</p>	

control of game cameras, fire safety serious games. At present (Sep 2012) four students are starting new projects involving: interactive 3D musical instruments (with KINECT); investigation of transfer of fire safety knowledge and skills from fictional (space ship) games to real world situations; automatic generation of 3D buildings from hand-drawn 2D sketches; and further investigation into computer control of in-game cameras.

Brief Description of Masters or PhD Project

The 4-year PhD research project aims to investigate the use of real time human movement motion capture to support the learning of sports, martial arts and dance motions. The project will involve the development of a serious game architecture, whereby individual poses, and sequences of poses are captured in real time, and compared with normalised 'ideal motions'. The game would involve users of the program to progressive through stages in the serious game, each increasing the number and accuracy of poses and pose combinations demonstrated, and progression from one stage to another would require passing performance 'tests' of combinations of movements.

The project will involve addressing several of the following research questions:

- Development of a data structure for human pose and pose-sequence data (i.e. sufficient for matching, but minimal size to support real time processing and comparisons)
- Real-time matching algorithm of motion capture data against stored 'ideal' poses and pose-sequences – i.e. Strategies for evaluating a sequence of human motions against a stored 'ideal' sequence, while making allowances for differences in body morphology (height / weight etc.)
- Matching player game goals with e-learning objectives – i.e. developing an entertainment driven task sequencing and evaluation strategy to lead to an effective serious game that players/learners find engaging and enjoyable while leading to measurable learning improvements

Key Attributes of Project for Brazilian Postgraduate Students

Should outline why projects offer something that is not available in Brazil – specific equipment, multi-disciplinarity, aspects of structured programme, links with industry, placements, links with other research groups, etc. Good opportunity for IoTs to emphasise their close working relationships with industry and particularly SMEs and their pivotal role in regional economic development

This project is highly interdisciplinary, involving computing, 3D games and real-time point-cloud technologies, artificial intelligence, educational theory and physical sports/arts disciplines. The PI and research group can provide experience, equipment and research support across this range of disciplines.

ITB offers a scheduled study module in research skills which the research student would undertake as part of their programme of study. Other relevant study modules available to the student include 3D modelling, and 3D game development – no previous experience with 3D modelling, game development of e-learning is assumed; only a good honours or masters degree demonstrating a good technical level of computer programming/scripting.

Recently the Graphics and Gaming Research Group has received equipment funding, including a commercial 3D room scanner, and a workstation dedicated to motion capture, to which the successful research student would have daily access during their project. Currently the group uses Microsoft

KINECT devices to process human-motion capture (recorded and in real-time).

In addition to his computing and education research track record, Dr. Smith has a background of practical knowledge and skills in the physical domain of the proposed research project (he is a qualified basketball referee, and an experienced martial artist in judo, fencing and taekwon-do martial arts; he also has experience as both a salsa DJ and salsa dancer). Qualified local pilates and taekwon-do instructors have been found who have agreed to take an active part in this research project.

Dr. Smith is currently co-authoring a book about 3D game development (release date Jan 2013) with the Brazilian lecturer and games developer Chico Queiroz: <http://www.atares.com.br/~chico/>

Name and contact details for project queries, if different from PI named above:

Please indicate graduate disciplines which are eligible for application:

- Computer Science
- Interactive Digital Media (with demonstrated scripting/programming skills)

Alignment with Science Without Borders Priority Areas:

Please indicate the specific programme priority area under which the proposed postgraduate project fits – choose only one (tick box)

Engineering and other technological areas	
Pure and Natural Sciences (e.g. mathematics, physics, chemistry)	
Health and Biomedical Sciences	
Information and Communication Technologies (ICTs)	<input checked="" type="checkbox"/>
Aerospace	
Pharmaceuticals	
Sustainable Agricultural Production	
Green Chemistry	
Oil, Gas and Coal	
Renewable Energy	
Minerals	
Biotechnology	
Nanotechnology and New Materials	
Climate Change	
Biodiversity and Bioprospection	
Marine Sciences	
Productive Inclusion and Social Technologies	
Housing and Sanitation	