

Page 1 – General Information

Project Code	TSEN01
Partner University	Teesside University
Faculty/School/Department/Research Centres	School of Science, Engineering and Design, Engineering Department
First supervisor Please provide name and weblink	Dr Vladimir Vukovic https://research.tees.ac.uk/en/persons/vladimir-vukovic
Second supervisor Please provide name and weblink	Professor Nashwan Dawood https://research.tees.ac.uk/en/persons/nashwan-dawood
Third supervisor Please provide name and weblink	Dr Charalampos Psarros
Fourth (external) supervisor	Dr Ana-Maria Roxin University of Burgundy, France http://le2i.cnrs.fr/-Ana-Roxin-?lang=fr
External/industrial supervisor	TBC
Which of the supervisors listed above is an early-career-researcher	Dr Charalampos Psarros (PhD, 2017)
Contact details for project for informal applicant queries Email address	v.vukovic@tees.ac.uk
DTA Programme: Please delete as necessary which DTA programme this project relates to:	DTA Energy
Project title	Augmented/Virtual reality and serious games as integrators of construction technology



Co-funded by the Horizon 2020 programme of the European Union

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 801604.

Page 2 – Project Description

<p>Scientific Excellence (500 words)</p>	<p>Attempts at creating augmented reality (AR) tools date back to the late 1960s but only in recent years the advancement of technology has allowed broader market acceptance with tools such as HoloLens, Meta2, Smart Helmet. Current applications include gaming, automotive and defence sectors, whereas the construction industry adoption is at its infancy. Existing developments in the construction sector relate to construction design and planning (SketchUp Viewer by Trimble, 2016).</p> <p>Applications in visualisation of real time building energy sensory information and energy consumption of white goods are yet to be realised. In particular, combination of such real-time energy data with simulated energy profiles using building information modelling and serious games opens excellent opportunities for scientific research. Such research builds upon previous successful endeavours at Teesside University to utilise serious games in construction health and safety training (Dawood et al. 2014).</p>
<p>Aim (400 words)</p>	<p>Aim of this PhD is to develop procedure and evaluate opportunities for utilisation of AR/VR tools in construction through serious games. The main research hypotheses is that AR/VR tools used in serious games can facilitate learning, engagement and attentiveness of AEC professionals leading to lower costs of construction, maintenance and operation of buildings.</p> <p>Methodology and innovations</p> <p>The study will employ desktop research and experimentation using already existing AR tools at Teesside University. Research will attempt to bring existing BIM model of a building (e.g. one of TU campus buildings) into AR and integrate near real-time information from building sensors. The result will be development of a gaming application in which the users could compete against each other while e.g. improving building</p>



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	<p>energy performance, attending health and safety training/learning, conducting maintenance. Evaluation of the impacts of the developed tool(s) will be conducted in collaboration with TU Estates team and/or industry partners.</p>
<p>Strategic Relevance (300 words)</p>	<p>AR tools present the future of human-computer interaction and offer tremendous potential to revolutionise future building design, maintenance and operation. This PhD is a step towards bringing the current computational advancements closer to construction practice, which is traditionally reluctant to change and slow to implement state of the art developments.</p> <p>From the organisational perspective, the topic is of strategic relevance to build international DTA Energy partnerships, in particular with University of Burgundy and potentially other French universities in the future through such a partnership.</p>
<p>Interdisciplinarity and fit with DTA3</p>	<p>Interdisciplinary nature of this topic is clear from the aim to address a variety of potential applications from construction to maintenance and operation of buildings. Fit within the DTA Energy programme is mostly related to the fact that buildings consume 40% of energy in developing countries, whereas building operation, requiring energy, is responsible for 80% of their total lifecycle costs.</p>
<p>Industrial Relevance (300 words)</p>	<p>Spearhead Innovation is a startup company which operates out of dedicated company startup premises at Teesside University. The supervisory team established close contacts with this company and explored possibilities for collaboration. As a result, company placement could be offered to interested PhD candidates. Additional opportunities may exist for placements within the construction sector companies which have previously supported TU research endeavours, e.g. WYG, Space Group, OHL,...</p>



<p>Economic and Societal Impact (300 words)</p>	<p>AR is a disruptive technology whose impacts are difficult to predict, but estimates could be made based on the recent experiences with comparable disruptive technologies, e.g. smartphones and tablets. Thus, potential impacts range from direct economic benefits from AR applications to implicit societal benefits in e.g. opening entirely new markets for AR apps etc.</p> <p>For example, research by Analysis Group, Inc. assumes a multiplication factor of 4.3 times the device cost when estimating the overall impacts on GDP from AR tools. Globally, such impact ranges between \$12 and \$100 billion between 2016 and 2020. As the construction sector represents about 10% of the global GDP, impacts from application of AR in construction could be estimated to range between \$1 and \$10 billion over this 5 year period. The current research aims to prove that such impact will result in reduced construction / maintenance / operational costs of the built assets.</p>
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Page 3 – Admission Requirements

<p>Specific Admission Requirements Detail any subject specific degree qualifications or disciplines, relevant skills, experience</p>	<p>Master degree in CAD, digital design, BIM, computer science or related area required with a GPA above 60%.</p>
<p>Minimum IELTS score</p>	<p>6.5</p>



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