

<b><u>Information on Postgraduate Research Scholarship - Ref: VCS-FES-11-22</u></b>			
<b>Faculty:</b>	Engineering and Science	<b>Department:</b>	Engineering
<b>Lead Supervisor:</b>	Dr Mohammad Sakikhales		
<b>Project Title:</b>	Digital twin for improved sustainable usage of Heritage Buildings		
<b>Project Description:</b>	<p><b>Description</b> Heritage assets face serious challenges including deterioration, inefficient maintenance and excessive energy usage. While previous attempts to utilise Historic Buildings (HBs) information modelling have been made, these have mainly focused on creating a 3D representation of the building. However, a more enriched model is needed to support preventive conservation strategies (Jouan and Hallot, 2020). Taking that HBs are live assets, there is an additional need to integrate performance data into these models to make them truly valuable. Consequently, creating a digital twin will not only provide for a digital replica of the asset but combined with continued data gathering allow for improved long-term management of HBs, additionally, it would allow for increased operational efficiencies and responding to real-time issues (Opoku et al., 2021)</p> <p><b>Objective and strategy</b> This research aims to understand the most important parameters (e.g. internal/external temperature, occupancy rate) to optimise the overall sustainability performance of the HBs. This will be achieved through a case study of developing a digital twin for the Queen Anne Building the at University's Greenwich campus.</p> <p>After laser scanning and using penetrating radar surveys to determine the building's physical data, a digital twin will be built using BIM authoring tools (e.g. Revit) and visual programming tools (e.g. Dynamo). The performance data will then be added from both building management systems and sensors installed around the building. The digital twin's data will then form the basis for suitable machine learning tools to learn about the asset and its operational patterns. This will then enable the development of different scenarios to simulate and optimise the decision-making of the building's operation, manage real-time issues and ensure long-term conservation. The digital twin would also be able to identify risk and threat scenarios that may arise in the future, e.g. related to climate change, such as the urban heat island effect and flooding.</p> <p>The outcome of this project will provide insight into optimising the management of Heritage buildings and consequently help to achieve SDG 11 (make cities and human settlements inclusive, safe, resilient and sustainable) by creating new jobs, reducing waste, improving sustainability, reducing CO2, enhancing the occupants' experience and contributing to the efforts in preserving global heritage sites.</p>		

	<p>The student will be expected to work on modelling the building through laser scanning &amp; radar survey and 3D modelling, installing performance monitoring sensors (e.g.: CO2, temperature, humidity, occupancy and window sensors), prototyping the digital twin by integrating the model and sensor data, analysing the operational data for predictive maintenance and operation and identifying improved operational/maintenance scenarios.</p> <p><b>References</b></p> <p>Opoku, D., Perera, S., Osei-Kyei, R. and Rashidi, M., 2021. Digital twin application in the construction industry: A literature review. <i>Journal of Building Engineering</i>, 40, p.102726.</p> <p>Jouan, P. and Hallot, P., 2020. Digital Twin: Research Framework to Support Preventive Conservation Policies. <i>ISPRS International Journal of Geo-Information</i>, 9(4), p.228.</p>
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<b>Duration:</b>	3 years, Full-Time Study or 6 years, Part-Time Study	
<b>Bursary available (subject to satisfactory performance):</b> Year 1: £17,668 (FT) or pro-rata (PT) Year 2: In line with UKRI rate Year 3: In line with UKRI rate		
In addition, the successful candidate will receive a contribution to tuition fees equivalent to the university's Home rate, currently £4,596 (FT) or pro-rata (PT), for the duration of their scholarship. International applicants will need to pay the remaining tuition fee for the duration of their scholarship.		
This fee is subject to an annual increase.		
<b>Person Specification of Essential (E) or Desirable (D) requirements:</b>		
<b>Criteria:</b>	<b>E or D</b>	
<b>Education and Training:</b>		
<ul style="list-style-type: none"> <li>1<sup>st</sup> Class or 2<sup>nd</sup> class, First Division (Upper Second Class) honours degree OR a taught master's degree with a minimum of 60% in all areas of assessment (UK or UK equivalent) in a relevant area to the proposed research Project (inclusive of but not limited to Architecture, Civil Engineering, Construction, Computational Modelling, Machine Learning or Data Science).</li> </ul>	<b>E</b>	
<ul style="list-style-type: none"> <li>For those whose first language is not English and/or if from a country where English is not the majority spoken language (as recognised by the UKBA), a language proficiency score of at least IELTS 6.5 (in all elements of the test) or an equivalent UK VISA and Immigration secure English Language Test is required if your programme falls within the faculty of Engineering and Science a language proficiency score of at least IELTS 6.5 overall with a minimum of 6.0 in all elements of the test or an equivalent UK VISA and Immigration secure English Language Test is required. Unless the degree above was taught in English <b>and</b> obtained in a majority English-speaking country, e.g. UK, USA, Australia, New Zealand, etc, as recognised by the UKBA.</li> </ul>	<b>E</b>	
<b>Experience &amp; Skills:</b>		
<ul style="list-style-type: none"> <li>Previous experience in undertaking research (e.g. undergraduate or taught master's dissertation)</li> </ul>	<b>E</b>	
<ul style="list-style-type: none"> <li>Experience with high-level programming languages such as Python, C++, C# or Java</li> </ul>	<b>E</b>	
<ul style="list-style-type: none"> <li>Experience in identifying patterns in large data sets</li> </ul>	<b>D</b>	
<ul style="list-style-type: none"> <li>Knowledge of Building Information Modelling (BIM)</li> </ul>	<b>D</b>	
<ul style="list-style-type: none"> <li>Knowledge of building performance simulation</li> </ul>	<b>D</b>	

• An understanding of Building operation procedures and/or regulations	D
• An understanding of Historic Building maintenance	D
• An understanding of sensor systems for (building) performance monitoring	D
<b>Personal Attributes:</b>	
• Understands the fundamental differences between a taught degree and a research degree in terms of approach and personal discipline/motivation	E
• Able to, under guidance, complete independent work successfully	E
• Self-motivated and a team player.	E
• Has excellent written and oral communication skills	E
• Being passionate about the topic of research	D
<b>Other Requirements:</b>	
• This scholarship may require Academic Technology Approval Scheme approval for the successful candidate if from outside of the EU/EEA	E
• The scholarship must commence before 31 <sup>st</sup> July 2023	E
<b>Closing date for applications:</b>	<b>midnight UTC on 13<sup>th</sup> March 2023</b>
<b>For further information contact:</b>	<b>Mohammad Sakikhales (m.sakikhales@greenwich.ac.uk)</b>
<p><b>Making an application:</b> Please read this information before making an application. Information on the application process is available at: <a href="https://www.gre.ac.uk/research/study/apply/application-process">https://www.gre.ac.uk/research/study/apply/application-process</a>. Applications need to be made online via this link. <b>No other form of application will be considered.</b></p> <p>All applications <b>must include</b> the following information. <b>Applications not containing these documents will not be considered.</b></p> <ul style="list-style-type: none"> <li>• <b>VC Scholarship Reference Number (Ref: VCS-FES-11-22)</b>– included in the personal statement section</li> <li>• <b>Personal Statement</b> - outlining your motivation for applying for this PhD, and your previous research experience (e.g., as a research assistant or completing a dissertation).</li> <li>• <b>Academic qualification certificates/transcripts*</b></li> <li>• <b>IELTS/English Language certificate if you are an international applicant or if English is not your first language or you are from a country where English is not the majority spoken language as defined by the UK Border Agency *</b></li> <li>• <b>Research Proposal*</b> (ca. 1500 words- please use the template available from: <a href="#">research-proposal-template.pdf (gre.ac.uk)</a>)</li> <li>• <b>academic qualification certificates/transcripts and IELTS/English Language certificate if you are an international applicant or if English is not your first language or you are from a country where English is not the majority spoken language as defined by the UK Border Agency *</b></li> <li>• <b>Your complete CV*</b></li> <li>• <b>Two reference letters (one ideally from a dissertation supervisor)*</b></li> </ul> <p><i>*upload to the qualification section of the application form. Attachments must be in PDF format. You will need to submit this as 1 single PDF, to be uploaded as an attachment.</i></p> <p>Before submitting your application, you are encouraged to liaise with the Lead Supervisor on the details above.</p>	