

Department	School of Engineering and the Built Environment
Supervisors	Prof. Islam Shyha, Prof. Ahmed Al-Dubai and Dr Suha Jaradat
Project Title	Innovative Energy Harvesting Solutions for Cyber-Secured Green Buildings
<p>PROJECT DESCRIPTION</p> <p>The built environment is approximately contributing to 30% of the total global energy consumption and around 27% of energy sector emissions. This multidisciplinary project aims to develop new techniques for harvesting energy from footsteps and acoustic energy sources (zero-net resources such as footstep mats, flexible solar panels, and sound detection) that can be used in green buildings, where data are collected, processed, and secured by a cyber-security system.</p> <p>The plan includes both synthesis and characterisation of piezoelectric nanofiber mats according to different mechanical/acoustic excitations. Subsequently, such mats will be embedded with electric setups within carpets and curtains. Besides, such a piezo system will be aligned with commercial flexible solar panels to coordinate the reception of harvested energy from multiple renewable resources inside the buildings. Then, a scenario of a user-centric and secure dashboard platform along with its cyber-security is presented for a completely automated and trustworthy green building. All the outputs aim to achieve the main aim of the project by offering innovatively automated and secured solutions for zero-net energy buildings. This project contributes to developing more features of the current initiated effort of green buildings, generating fundamental knowledge that will be ripe for exploitation in a range of novel technological areas regarding sustainability and security.</p> <p>Perspective applicants are encouraged to contact the Supervisor before submitting their applications. Applications should clearly refer to the project you are applying for and the name of the supervisors.</p> <p>Academic qualifications</p> <p>A first degree (at least a 2.1) ideally in Mechanical Engineering with a good fundamental knowledge of Materials Science, sustainable building design and cybersecurity.</p> <p>English language requirement</p> <p>IELTS score must be at least 6.5 (with not less than 6.0 in each of the four components). Other, equivalent qualifications will be accepted. Full details of the University's policy are available online.</p> <p>Essential attributes:</p> <ul style="list-style-type: none"> • Experience of fundamental Materials Science and Manufacturing • Competent in conducting laboratory experimentation and data analysis • Knowledge of materials characterisation, sustainable building design and cybersecurity • Good written and oral communication skills • Strong motivation, with evidence of independent research skills relevant to the project • Good time management <p>Desirable attributes:</p> <p>Some understanding of green and zero-net energy buildings, cybersecurity and architectural engineering.</p>	
Indicative Bibliography	<p>Bedi, G., Venayagamoorthy, G.K., Singh, R., Brooks, R.R. and Wang, K.C., 2018. Review of Internet of Things (IoT) in electric power and energy systems. <i>IEEE Internet of Things Journal</i>, 5(2), pp.847-870.</p> <p>Elnabawy, E., Farag, M., Soliman, A., Mahmoud, K., Shehata, N., Nair, R., Kandas, I., Atif, R., Combrinck, M., Khaliq, J. and Shyha, I., 2021. Solution</p>

	<p>blow spinning of piezoelectric nanofiber mat for detecting mechanical and acoustic signals. <i>Journal of Applied Polymer Science</i>, 138(45), p.51322.</p> <p>Omran, N., Elnabawy, E., Le, B., Trabelsi, M., Gamal, M., Kandas, I., Hassanin, A.H., Shyha, I. and Shehata, N., 2022. Solution blow spun piezoelectric nanofibers membrane for energy harvesting applications. <i>Reactive and Functional Polymers</i>, 179, p.105365.</p> <p>Su Peng, Liang Zhao, Ahmed Al-Dubai, Albert Y. Zomaya, Jia Hu, Geyong Min, Qiang Wang, Secure Lightweight Stream Data Outsourcing for Internet of Things. <i>IEEE Internet Things Journal</i>, 8(13): 10815-10829 (2021).</p> <p>B. Ghaleb, A. Al-Dubai, E. Ekonomou, M. Qasem, I. Romdhani and L. Mackenzie, "Addressing the DAO Insider Attack in RPL's Internet of Things Networks," in <i>IEEE Communications Letters</i>, vol. 23, no. 1, pp. 68-71, Jan. 2019, doi: 10.1109/LCOMM.2018.2878151.</p>
Enquiries	For informal enquiries about this PhD project, please contact Prof. Islam Shyha, i.shyha@napier.ac.uk , Prof. Ahmed Al-Dubai (a.al-dubai@napier.ac.uk) and Dr Suha Jaradat (s.jaradat@napier.ac.uk)
Web page	https://www.napier.ac.uk/research-and-innovation/research-degrees/application-process