Full project description for RS667:

This project will explore how technological advancement in micro-CT/X-ray microscopy (XRM), and virtual reality (VR) allow us to create accurate and interactive 3D models based on real-life components related to our Net Zero future, and organisms crucial to our environmental sustainability. The resources developed as part of the Master's project will provide a unique insight into hidden and complex structures like the internal workings of modern batteries, solar cells, advanced home insulation, bioenergy and renewables. In addition, 3D imaging and virtual reality can also reveal the complexity and intricacies of the environment around us in an engaging way. Similar resources will be developed to highlight the rich natural diversity in our environment that is crucial to a holistic balance of nature and innovation, essential to society's drive towards Net Zero.

The research aim of the project will be to develop and describe methods used to produce educational and engaging resources for 3D exploration in VR, with a workflow from real specimens, through micro-CT/XRM, to virtual reality.

The research basis for engaging communities, stakeholders, and learners through VR is developing. For outreach and teaching, VR has been demonstrated to enrich the teaching process, providing a unique practical experience that assists learning [1]. The delivery of VR outreach programs can greatly influence how children process new information, and for Net Zero and environmental sustainability, capturing student interest will assist in the education and communication of important environmental issues [2]. The novelty of VR and 3D visualisation as an interactive technology improves student/user motivation and retention more than traditional methods, due to its collaborative and immersive nature [3].

In addition to educational outreach in schools or universities, VR has the capacity to be used as an outreach tool in community settings. Its novelty, versatility and ability to provide an enhanced experience makes VR an increasingly popular attraction for those who wish for a more authentic or fully immersive experience [4]. The ability to easily create an environment of a place that no longer exists or is difficult to access (such as a hidden or microscopic structure) alongside an informative guided tour helps to facilitate understanding and learning of the human-made and natural world [5].

The outputs of the proposed Master's project will be a developed workflow, with varied audiences in mind, from children to adults. The resources developed within the project will be virtual reality classroom environments; these will detail internal 3D structures that contribute to the effectiveness of Net Zero-related materials and components, to the people who will live around these and use them in future. In addition, the complex and beautiful hidden structures in some of the crucial living organisms in our environment (plants, insects, pollinators etc) will be imaged and 3D resources developed in the same way. Also, for audiences that don't have access to VR hardware, 360 and immersive videos will be developed. For visually impaired audiences, a parallel set of resources will be developed utilising scaled-up 3D prints of the structures, creating accessible tangible versions at a much larger scale than the real item.

The project will also involve user engagement activities with audiences in Neath-Port Talbot to develop a two-way dialogue around Net Zero technologies and the developed 3D resources; this is to evaluate their effectiveness at engaging audiences and providing new insights into Net Zero-related materials/components, and the natural world around us. The project will be based primarily at Swansea University's Bay Campus and the successful candidate will be based there.

References:

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1. FJ Weeks and CY Oseto. *Insects* **9**. (2018).

1. S Kavanagh et al. *Themes in Science and Technology Education,* **10**. (2017).

1. H Lee et al. *Information & Management,* **57**. (2020).

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