PhD Advert Template

Project title: Development of Cognitive Digital Twin for Predictive Maintenance of Building Facilities

Project ID *(optional)*: *Please leave blank*

Accept all year-round applications

Funding information: Self-funded students only

Project description:

**About the project:**

As an emerging concept, digital twins have been adopted to save costs and improve reliabilities in many different industries, including the Architecture, Engineering and Construction (AEC) industry. As the dynamic digital representation of a real-world counterpart, the digital twin can unleash great value if applied across the whole life cycle of the asset of interest.

Post-construction maintenance of building systems plays a critical role in reducing the operational carbon footprint of buildings in the UK, which made up 18% of the UK’s total emissions in 2019. Collecting data throughout the asset lifecycle allows the digital twin to better predict the remaining service life and remaining energy-efficient life of components. In this way, a predictive maintenance strategy can be implemented, avoiding downtime and optimising system reliability and energy performance. In this project, the digital twin will be developed, with augmented cognitive capabilities to capture the characteristics and status of a component and how it interacts with other components in a complex multi-component system. Leveraging semantic technologies such as ontology and knowledge graphs, the idea of the cognitive digital twin will be explored, to track the through-life degradation of an asset or process.

The candidate will conduct the research based on the data from the intensively monitored Urban Sciences Building, located on Newcastle Helix in the heart of the city. As a living laboratory underpinning research to make urban centres more sustainable for future generations, the building contains over 4,000 digital sensors, providing high resolution data about environmental, mechanical and electrical performance. Engagement with wide industrial partners, like Siemens, is expected to expand the impact of research.

**Prerequisites:**

Essential: Applicants will normally hold a first or 2:1 undergraduate degree or a master’s degree in a subject relevant to the research project.

Desirable: Knowledge of building information modelling, building facility management and machine learning; strong programming skills and willingness to learn semantic web technologies.

*Newcastle University is committed to being a fully inclusive Global University which actively recruits, supports and retains colleagues from all sectors of society. We value diversity as well as celebrate, support and thrive on the contributions of all our employees and the communities they represent. We are proud to be an equal opportunities employer and encourage applications from everybody, regardless of race, sex, ethnicity, religion, nationality, sexual orientation, age, disability, gender identity, marital status/civil partnership, pregnancy and maternity, as well as being open to flexible working practices.*

References (optional):

Xie, X., Merino, J., Moretti, N., Pauwels, P., Chang, J. and Parlikad, A., 2022. Digital twin enabled fault detection and diagnosis process for building HVAC systems. Automation in Construction.

Xie, X., Moretti, N., Merino, J., Chang, J., Pauwels, P. and Parlikad, A., 2022. Enabling Building Digital Twin: Ontology-Based Information Management Framework for Multi-source Data Integration. Proceedings of the 22nd CIB World Building Congress. <https://doi.org/10.17863/CAM.83062>

Xie, X., Lu, Q., Herrera, M., Yu, Q., Parlikad, A.K. and Schooling, J.M., 2021. Does historical data still count? Exploring the applicability of smart building applications in the post-pandemic period. Sustainable Cities and Society, 69, p.102804. <https://doi.org/10.1016/j.scs.2021.102804>

Lu, Q., Xie, X., Parlikad, A.K. and Schooling, J.M., 2020. Digital twin-enabled anomaly detection for built asset monitoring in operation and maintenance. Automation in Construction, 118, p.103277. <https://doi.org/10.1016/j.autcon.2020.103277>

Application enquires: [*Xiang Xie*](mailto:xiang.xie@ncl.ac.uk)[*https://www.ncl.ac.uk/nuact/fellows/profiles/xiangxienewcastleacuk.html*](https://www.ncl.ac.uk/nuact/fellows/profiles/xiangxienewcastleacuk.html)

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automotive engineering

bioengineering

biomedical engineering

chemical engineering

civil engineering

communications engineering

control systems

cybernetics

dynamics

electrical engineering

electronic engineering

energy technologies

environmental engineering

fluid mechanics

gas engineering

geotechnical engineering

integrated engineering

manufacturing engineering

marine engineering

mechanical engineering

mechanics

mechatronics

nanotechnology

offshore engineering

petroleum engineering

robotics

solid mechanics

structural engineering

structural mechanics

systems engineering

thermodynamics

other

Environmental Sciences

climate science

hydrology

marine sciences

meteorology

pollution

soil science

other

Finance

actuarial science

banking

financial management

insurance

investment

taxation

other

Food Sciences

food hygiene

food production

other

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forensic science

other

Geography

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cultural geography

economic geography

environmental geography

geographical information systems gis

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human geography

marine geography

physical geography

political geography

remote sensing

social geography

transport geography

urban geography

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geochemistry

geophysics

geoscience

geotechnology

hydrogeology

marine geology

palaeontology

seismology

volcanology

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History & Archaeology

african history

american history

ancient history

archaeology

asian history

australasian history

british and irish history

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heritage studies

history

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military history

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contract law

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classics

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linguistics

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probability

pure mathematics

statistics

stochastic processes

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anatomy

audiology

biomechanics

cardiology

complementary medicine

dentistry

endocrinology

epidemiology

neural engineering

neurology

nutrition

ophthalmology

optometry

pathology

pharmacology

pharmacy

physiology

physiotherapy

podiatry

radiology

speech science

tissue engineering

toxicology

other

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adult nursing

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environmental health

health informatics

medical nursing

mental health nursing

midwifery

occupational health

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metaphysics

philosophy of science

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astronomy

astrophysics

chemical physics

computational physics

electromagnetism

environmental physics

experimental physics

medical physics

nuclear physics

optical physics

particle physics

quantum mechanics

solid state physics

space science

theoretical physics

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politics

public policy

other

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child psychology

clinical psychology

community psychology

counselling psychology

developmental psychology

educational psychology

forensic psychology

health psychology

neuropsychology

occupational psychology

organisational psychology

psychotherapy

sport psychology

other

Sociology

criminology

disability studies

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sport development

sport performance

sport technology

sport therapy

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theology

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animal welfare

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veterinary pathology

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