Wolfson School of Mechanical, Electrical, and Manufacturing Engineering

Loughborough University

Research Associate in Circular Robotic Manufacturing

Job Ref: REQ260399

School/Department summary:

There is a vacancy within the Centre for Sustainable Manufacturing and Recycling Technologies (SMART) at Loughborough University for a talented and enthusiastic new Post-Doctoral Research Associate with strong interest in robotic manufacturing, circular economy, industrial sustainability, remanufacturing and recycling, and a background in mechanical, manufacturing, and robotic control engineering.

Loughborough University is renowned for the relevance of its research. Research undertaken at Loughborough helps business and industry to compete more effectively, shape public policy and ultimately improve the quality of people's lives. Loughborough has a research community made up of more than 2,200 staff and students, and is well known for having a wide range of research partnerships with multi-national businesses and has long-standing collaborative links with many public and private sector organisations. As one of the largest engineering schools in the UK, the Wolfson School is a leader in technological research and innovation, with extensive national and international connections to industry and has benefited from a recent £70 million investment into the west side of campus.

The Centre for SMART was first established within the Wolfson School of Mechanical, Electrical and Manufacturing Engineering in 2004. The Centre's mission is to develop the new strategies, methodologies and supportive technologies required to implement a sustainable approach to the design, production, consumption and disposal of manufactured products thereby helping to safeguard the future of the planet. The Centre has core expertise and knowledge in life cycle analysis, sustainable design, resource and energy efficient manufacturing, end of life processing of products, and sustainable consumption and business models that are key enablers for achieving transformational change. Our industrially focused research enables us to work with some of the world's most renowned engineering and commercial companies.

Project Description: The UK is embarking on an ambitious plan to further robotise its renowned manufacturing sector. According to the International Federation of Robotics, there were an average of 101 industrial robots (IRs) per 10,000 employees in operation in the UK in 2020, while the 'industrial robots' market is predicted to grow at a compound annual growth rate of over 40% per annum between 2020 and 2030. This rapid increase in application could, without a strategic deployment, result in many decommissioned robots which together with their controllers and associated digital equipment (e.g. sensors, vision systems, etc.) often contain a large amount of critical raw material (CRM). At present, preventive maintenance is conducted to increase the longevity of IRs typically through pre-scheduled manual checks, visual inspections, equipment testing, and adherence to standard operating procedures which are not customised to specific requirements of different IR applications. The shortcomings of this approach include potential over-maintenance, reduced productivity, high costs, and the possibility of missing non-obvious faults. In addition, due to uncertainties (lack of trusted monitoring data) during use stage, the EoL management involves costly refurbishment to enable a secondary use cycle (often by a different end-user) and/or downcycling of CRM due to adoption of inappropriate material recycling processes. This highlights the urgent need for novel digitally enabled solutions to support a proactive, real-time data-driven lifecycle maintenance of IRs to extend the useful life as well as intelligent decision making at EoL stage to achieve an optimum balance between cost-efficiency, optimal equipment performance, and environmental sustainability. The proposed research aims to tackle both present and looming challenges arising from the environmental impacts of industrial robots, as one of the most widely employed class of digital manufacturing technologies across diverse sectors including automotive, aeronautical, food, and healthcare.

This Engineering Physical Science Research Council (EPSRC) funded research is a collaborative project involving the Centre for SMART, the School of Design in Royal College of Art, Centre for Robotics Research in Kings Collage London, Department of Computer Science in University College London, Manufacturing Technology Centre in Coventry and 8 industrial partners representing manufacturers and users of industrial robots. The overall project aim

is to investigate digital solutions to promote a circular use of traditional/collaborative industrial robots (IR) in manufacturing lines by extending the useful life as well as enabling their end-of-life (EoL) remanufacturing and recycling of embedded strategically critical materials.

The major research challenges are: to extend the operational lifespan of IRs, minimising the necessity for costly repairs or replacements, and promote effective remanufacturing and/or circular use of embedded CRM, thus significantly cutting embedded CO2 emissions in producing new robots.

The project lead at Loughborough University is Prof Shahin Rahimifard.

Job Description

Job Family and Grade: Specialist and Supporting Academic Research Grade 6

Job Purpose

The Postdoctoral Research Associate will work as part of the wider research programme to design and implement a digitally enabled real-time system for extending the life of industrial robots during the use stage as well as developing new circular design framework and guidelines to promote end-of-life remanufacturing and recycling of embedded strategically critical materials. This includes the development of AI-based life cycle assessment as well as life cycle costing models to support decisions related to the selection of most appropriate end-of-life options for industrial robots within a range of industrial sectors, including automotive, aeronautical, food, and healthcare. The Research Associate is also expected to take lead in engaging with key stakeholders across the value chain of IRs and development of research proposals for future expansion and continuation of this research.

Job Duties

Research

- To conduct a programme of physical disassembly experimentations to identify the main failure points of robots within a range of industrial settings.
- To design and implementation of a digitally enabled real-time system for extending the life of industrial robots during the use stage.
- To develop a decision support model based on life cycle sustainability assessment to identify most appropriate reprocessing options for IRs.
- To develop bespoke sensory devices and associated machine learning algorithm to collate rand analyse real-time to support refurbishment and remanufacturing of IRs
- To develop guidelines for a ‘design for circular economy’ approach to improve the remanufacturing, reuse and/or material recycling of IRs.
- To collate, analyse, synthesise, interpret and present research data related to various experimentation programmes.
- To write research papers suitable for publication in high quality academic journals.
- To liaise with academic and industrial project partners, and with supervision to assist with coordinate activities across the consortium.

General, Technical

- To perform risk assessments, develop method statements and implement safe working practices.
- To manage technical equipment and provide training to other users as required.
- To actively engage with industrial and other non-academic stakeholders to determine system requirements and identify and address potential barriers for implementation.
- To regularly report research progress to the programme management group through formal and informal reports and communications.
- Travel to attend project meetings, engagement events and conferences and to feed back to the project team on progress, to make recommendations for next steps.
- To lead the development of research proposals and grant applications for follow-on project funding.
- To supervise student projects in related areas.
- To undertake general lab organisation and coordination tasks

General and Administrative

- To work effectively with relevant administrative, technical and academic staff in the School and across the University.
- To engage in training programmes in the University (e.g. through Staff Development) which are consistent with the RA's ongoing professional development, and the needs and aspirations of the project team and those of the School.
- To maintain confidentiality where relevant at all times and ensure that intellectual property agreements are not violated.
- To support the academic staff in the project team with the supervision of undergraduate MSc work and day-to-day supervision and support of other researchers.
- To support Sustainable Engineering teaching delivery as required.
- To carry out specific other duties as may be reasonably requested by the project leaders and that are commensurate with the nature and grade of the post.

Points To Note

The purpose of this job description is to indicate the general level of duties and responsibility of the post. The detailed duties may vary from time to time without changing the general character or level of responsibility outlined in the document.

Organisational Responsibility

Reports to: Shahin Rahimifard, Professor of Sustainable Engineering
Direct Reports: N/A
Budget Responsibilities: N/A
Structure Chart: N/A

Person Specification

Your application will be assessed based on the essential and desirable criteria listed below.

Applicants are strongly encouraged to explicitly demonstrate how they meet each essential (and desirable) criteria at the application stage. The criteria that you need to demonstrate in your application will be listed as Stage 1 in the table below.

Stages of assessment are as follows:

1 – Criteria measured at Application
2 – Criteria measured at Test/Assessment Centre/Presentation
3 - Criteria measured at Interview

Essential Criteria:

Area	Criteria	Stage
Experience	Experience of robot control and programming, algorithms for machine learning and big data analysis	1,2,3
	Experience of the fields of manufacturing, remanufacturing and recycling technologies and automation processes	1,2,3
	Experience of developing circular and modular design guidelines and use of computer-aided design systems, preferably to support IR design	1,2,3
	Experience of setting up laboratory experimentational rigs, including both the control software and hardware elements	1,2,3
	Experience of generating project reports or other forms of research outputs.	1,2,3
	Experience of presenting project findings and adapted to specific audience needs, ranging from academic experts to general public	1,2,3
Skills and abilities	Ability to coordinate project activities, manage project tasks, prioritise and meet deadlines	1,3
	Excellent written, oral communication, interpersonal, and organisational skills	1,3
	Able to manage time and task effectively to meet project deadline and prioritise workload with minimum supervision	1,3
	Able to build and maintain effective working relationships with academic colleagues, students, and external partners to support collaborative research and communication of findings.	1,3
	Knowledge of technical software packages including MATLAB, CAD and LCA,	1,3
	Knowledge of specific analytical, numerical methods for environmental and economic assessments	1,3
	Skills in finding information in the scientific literature and proposing original ideas	1,3
	Skills in writing project reports and make technical presentations to industrial and academic research groups	1,3
	Knowledge of relevant Health & Safety issues	1,3
	Ability and willingness to support with preparation of industrial and stakeholder engagement meetings, seminars and webinars.	1,3
Training	A willingness to undertake further training as appropriate and to adopt new procedures as and when required	1,3

Qualifications	Have or soon to have a PhD in Mechanical, Manufacturing, Electronic or Robot Control Engineering.	1
Other	Uphold and actively contribute to the University's commitment to Equity, Diversity and Inclusion.	1,3
	Ability and willingness to travel to national and international partners, and do 1–3 week(s) secondment to project partners	1,3

Desirable Criteria:

Area	Criteria	Stage
Experience	Experience of a whole system view of industrial sectors, including automotive, aeronautical, food, and healthcare	1,3
	Knowledge of environmental standards, in particular ISO14000 family of standards and principles	1,3
	Experience of working in a high-quality academic research environment	1,3
	Experience in supervising junior members (e.g. PhD or final year project students)	1,3
	Experience of process design and system engineering	1,3
Skills and abilities	Authoring original work, in the highest quality refereed academic journals	1,3
	Ability and willingness to work collaboratively with project partners in different locations	1,3
Qualifications	MATLAB and Python programming, and/or LCA/LCC modelling	1,3

Conditions of Service

The appointment will be subject to the University's Terms and Conditions of Employment relevant to the job grade.

Shared University Responsibilities

As a member of the Loughborough community, you are expected to:

- Take reasonable care of yourself, others and the environment, and to prevent harm by your acts or omissions. All staff are therefore required to adhere to the University's Health, Safety and Environmental Sustainability Policies & Procedures.
- Support and contribute to the University's commitment to Equity, Diversity, and Inclusion (EDI), while carrying out all duties in a way that respects these principles and upholds the right to free expression. Further information about EDI at Loughborough and our strategic aims is available on our website

Our Purpose, Vision, and Values

Our purpose, Vision and Values underpin all that we do and shape how we work together at Loughborough.

We're proud to promote our values: **Adventurous**, **Collaborative**, **Creative**, **Authentic** and **Responsible**. Our people bring these values to life every day, and they are central to the positive and supportive culture that makes Loughborough unique.

If you join us, you'll be encouraged to bring these values to life in your own work and contribute to the positive, supportive culture that makes Loughborough unique.

Read more about our **vision and values**.

Our Accreditations

We strive to create a culture that supports equality and celebrates diversity throughout the campus. The University holds a Bronze Athena SWAN award which recognises the importance of support for women at all stages of their academic career.

We are proud to be a Race Equality Charter Member. The Charter aims to improve the representation, progression and success of all minority ethnic staff and students within higher education and address issues of racism within higher education institutions (HEIs).

We are proud to be a Disability Confident Employer and have adopted a proactive approach to employing disabled people and to creating a more diverse workforce. We ensure that our recruitment processes are inclusive and accessible. We guarantee to offer an interview to all applicants who have declared themselves with a disability, provided they meet the essential criteria for a role. We proactively anticipate and provide reasonable adjustments and support existing employees who acquire a disability or long-term condition to thrive in the workplace.

We are a real living wage employer, and our Living Wage Employer Mark shows our commitment to paying our staff according to the cost of living.

We are proud supporters of the City of Sanctuary movement and delighted to be recognised as a University of Sanctuary. This national network brings together, university staff, lecturers, academics and students, who together work to make Higher Education institutions place of safety, solidarity and empowerment for people seeking sanctuary.

As part of the University's ongoing commitment to redeployment, please note that this vacancy may be withdrawn at any stage of the recruitment process if a suitable redeployee is identified.