TAL TECH

AI based Intelligent workplace for flexible manufacturing

Summary

The main objective of the research is to develop the intelligent workplace of mechanical product assembling with AI functionality, for flexible manufacturing in the field of mechanical engineering, electronics, furniture, and food industries.

Research field:	Production and materials engineering, robotics, transport and logistics
Supervisors:	Prof. Dr. Jüri Majak
	Kristo Karjust
Availability:	This position is available.
Offered by:	School of Engineering
	Department of Mechanical and Industrial Engineering
Application deadline:	Applications are accepted between June 01, 2024 00:00 and June 30, 2024 23:59 (Europe/Zurich)

Description

To achieve a new momentum the manufacturing industry leaders must investigate and develop ways of automating, digitalizing its processes and linking data to increase efficiency. In production where, manual labour share remains high due to design constraints the efficiency growth can be established through intelligent solutions which speed up the assembly work and assure quality performance. In a future work station, the production employee must be supported with system info about how to assemble the product, which tools to use, feedback if connections have been made with correct torques, right components assembled in right order and instructed how to correct the mistakes in real time. For resource management the production management needs to have visibility about each workplace (manual or automated workplace) stations performance in real time in order to be able to react in prompt way according to the real time data of the workplace.

Workplaces and their optimization and modification procedures are considered as basis for company performance improvement. Factors influencing the workplace performance influence the whole company through the processes and systems, which the workplace is related and because of that it is crucial to development and optimization the intelligent mechanical product assembling workplace.

Workplaces of mechanical product assembling are constrained by manual assembly work, lack of data integration, dependency of manual data input about production efficiency and quality performance. Production output control process contains waste (muda) due to faults not becoming visible before final inspection and depends on human work discipline and eye for errors.

The developed intelligent workplace has link data of: tools being used eg torque wrenches and the applied torques per each critical connection; assembly time, assembler info, product number; interactive/digital product assembly instructions created; work quality monitored real time monitoring system and AR solutions, sensors and performance feedback given to worker in real time; data integration to the ERP system. All digital solutions are linked and operate as one system. These technologies will help to increase overall productivity, production efficiency and quality.

Responsibilities and (foreseen) tasks

- Concept development for intelligent workplace of mechanical product assembling for flexible manufacturing;
- Development of smart data collection system for intelligent workplace;
- Intelligent workplace human or robot movements optimization using Artificial Intelligent and Machine Learning concepts;
- Development of intelligent workplace prototype for flexible manufacturing.

Applicants should fulfil the following requirements:

- a master's degree in engineering
- practical and research competences and knowledge in electronics solution design
- a clear interest in the topic of the position
- excellent command of English

- strong and demonstrable writing and analytical skills
- capacity to work both as an independent researcher and as part of an international team
- capacity and willingness to help in organizational tasks relevant to the project

The following experience is beneficial:

- General/basic understanding on numerical analysis of structures
- Programming in C++
- Working knowledge of SQL
- Working knowledge of statistics

We offer:

- 4-year PhD position in one of the largest, most internationalized and leading engineering research centers in Estonia
- Opportunities for manufacturing companies visits and on-site projects

About the department

The Department of Mechanical and Industrial Engineering (DMIE) of TALTECH has 105 employees, includes 13 professors and 1 leading researcher; researchers and PhD students – altogether 85 members.

The DMIE deals with product development, production engineering, transportation engineering and logistics, industrial engineering and management, materials science, metal processing and technology of other engineering materials.

The main research interests are digital manufacturing, optimal design of composite and functional material structures, products and manufacturing processes (theory and methodology), manufacturing systems proactivity and production monitoring and optimization. There are several research laboratories: Rapid Prototyping, Product Modelling and System Dynamics, Acoustics, Transportation Engineering, Logistics Engineering and Supply Chain Management, Powder Metallurgy and Metal 3D Printing, Coatings, Tribology, and Milling Technologies.

The DMIE has enlarged in last five years, having two fully renovated and newly equipped research premises by ERDF project funded 13 M EUR. Currently DMIE is leading a national strategic research infrastructure project Research Roadmap for preparation of the Smart Industry Centre, investing into R&D of smart manufacturing during next two years 1.8 M EUR and European Digital Innovation Hub (EDIH) in Estonia called AIRE (AI & Robotics Estonia).

For further information, please contact Prof Kristo Karjust kristo.karjust@taltech.ee

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