TUM Asia doctoral candidate scholarship position

Research Topic: Digital Twin based Lean Construction Logistics for High-Density-Good Supply and Disposal in Urban Environments

TUM Asia Graduate College in Singapore is focusing on research around New Technologies and Processes for Passenger and Cargo Transport for cities of the future. There is a worldwide trend of growing urban population. At the same time there is the need to reduce the usage of natural resources, to reduce the air and noise pollution and further improve the living quality for the people living in the cities. This will lead to changes, how cities must be planned, constructed, and managed. Cities must move to a more sustainable development. The TUM Asia Graduate College deals with these challenges by focusing on serval new Technologies and Processes for Passenger and Cargo Transport. We are looking to fill a doctoral candidate position in the College with the research focus on:

Digital Twin based Lean Construction Logistics for High-Density-Good Supply and Disposal in Urban Environments

The research project aims to develop an innovative and scalable logistics system for high density goods (e. g. concrete, heavy machinery, building super structures, etc.) in order to efficiently and effectively supply and dispose urban construction sites.

The aspect of construction logistics in particular, which is responsible for the supply and disposal of construction sites, can benefit from the use of digital technologies in the future in order to increase productivity and flexibility as well as sustainability in the form of cost and resource efficiency, but also urban quality of living.

One example is the use of tracking and tracing technologies, such as RFID, to support the search for materials, which currently accounts for around 30% of working time and increased traffic around constructions sites. Furthermore, new lean logistics strategies can minimize the number of trucks and the packaging of materials through consolidation centers to improve the last mile. Driven by high requirements regarding handling, reliability, and time, these consolidation centers are a complex intralogistics system strongly depending on the particular good group that shall be handled.

Methods of Model-Based Systems Engineering (MBSE) have been successfully applied in a tailored modeling approach and should be applied in this project to specify a generic center system architecture. Based on this system architecture an exemplary good-specific variant of the center is derived with focus on intralogistics freight handling. The chosen design approach is further evaluated regarding its suitability in context of intralogistics system design.

A higher-level digital twin - consisting of linked simulations of the individual elements of the process chain (supply, demand, disposal) - is to be created and

implemented in a software-based tool. Using edge devices that generate live activity data and AI methods, the tool is optimized regarding the accuracy of construction progress and material demand estimates.

As a result, the readiness for use and the economic viability of the digital twin software for the supply and disposal of high density goods in urban areas will be demonstrated.

The supervision at TUM will be performed by the Chair of Materials Handling, Material Flow, Logistics, Univ.-Prof. Dr.-Ing. Johannes Fottner.

The research position is funded by the German Academic Exchange Service (DAAD) and TUM Asia and offers a full-time, fixed-term position at the TUM Singapore Campus. You will be enrolled as an active doctoral candidate in the TUM Graduate School with the objective to obtain a doctoral degree awarded by TUM. You will be based in Singapore and be a member of a small group of doctoral students working together in the TUM Asia Graduate College, and will have the opportunity to spend some time at the main TUM Campus in Munich, Germany.

Given TUM's strategic collaboration with the Nanyang Technological University (NTU, Singapore), there is also the option to obtain a joint TUM-NTU doctoral degree, if you also fulfil the NTU PhD requirements and are accepted by NTU.

The scholarship is tenable for one year in the first instance and is renewable subject to good research performance. The maximum period of the Scholarship is 4 years for PhD candidates, as determined by the school, as well as availability of research funding in each case.

- Monthly Scholarship: 3000 SGD
- Starting Date: ASAP, ideally 1st August 2024

Requirements:

- A master's degree in a relevant area like Mechanical/ Industrial/ Civil/ Transportation engineering, Logistics or equivalent.
- Enthusiasm for shaping the future of construction logistics and cargo transport with applied research.
- Theoretical knowledge or specific practical experience in process analysis, lean logistics, digital twin development, IoT-data acquisition and handling.
- Experience and interests in using modelling and simulation tools like SysML, UML, Plant Simulation or anylogic.
- Ability to work in a multicultural environment.
- Motivation to publish research papers in relevant high ranked journals / conferences.

Interested candidates should send their full applications via email, including a resume, academic transcripts and a cover letter to: phd.admission@tum-asia.edu.sg