

## Master/Bachelor Thesis

### Multi-Sensor based Prevention, Detection, and Recovery of Failures in Cargo Box Palletization using Gantry Robots

Availability: April 2017, Singapore

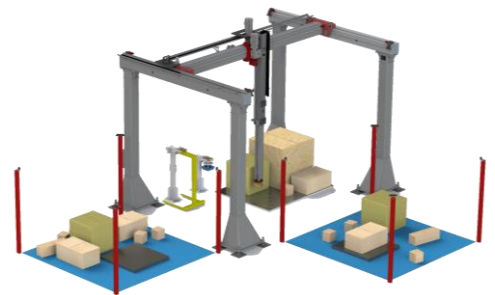
Contact: Nikhil Somani ([nikhil.somani@tum-create.edu.sg](mailto:nikhil.somani@tum-create.edu.sg))

#### Background

---

The design of real-world robotic systems is a multi-disciplinary effort. It involves the development of mechanical elements like sensors and actuators, electronic components for connecting and controlling the mechanical elements and software for higher-level planning and process control.

The core application is palletization and de-palletization of air freight cargo boxes using a large gantry robot. The end effector for this system consists of interchangeable tools, currently a vacuum gripper and a crane fork tool for larger boxes. Gripping failure may occur depending on the type of box material, weight, shape etc. Additionally, process failures involving other subsystems or the human worker can occur. Preventing and detecting such failures using multiple sensors, and designing appropriate recovery strategies are the major tasks of this work.



More details: <http://ac2.tumcreate.org>

#### Objective & tasks

---

1. Online classification of cargo boxes regarding lifting suitability with different tools.
2. Integration of additional sensors (proximity, laser, vision etc.) over a real-time network to improve the robustness and capabilities of the system, especially for de-palletization.
3. Development and implementation of algorithms for a robust detection of failures using data of various sensors at high-level and low-level process control.
4. Development and integration of recovery strategies, both autonomous and with human-robot-interaction.
5. Verification and validation of algorithms and strategies in simulation and on the robotic system.

#### What we expect from you

---

- Possess skills/ familiar with tools - C++, Python, Linux, git, ROS
- Knowledge of real-time protocols, e.g. Ether-Cat
- Familiarity with SolidWorks/Catia, Matlab, Simulink, PLCs is a plus
- Knowledge of machine learning and experience working with industrial robots is a plus.

#### What we offer you

---

- An international and multidisciplinary working environment
- Opportunity to work on a state of the art robotic system
- Challenging tasks with real-life relevance

#### ABOUT TUM CREATE

---

TUM CREATE innovates. We are developing cutting-edge electric vehicle technologies and pioneering the *Ultimate Public Transport System* concepts for the growing transport and sustainability challenges in fast-growing tropical megacities. Germany's *Technical University of Munich (TUM)* and Singapore's *Nanyang Technological University (NTU)* — two world-leading engineering universities — have come together to collaborate on this ambitious joint research programme. It is funded by Singapore's National Research Foundation.