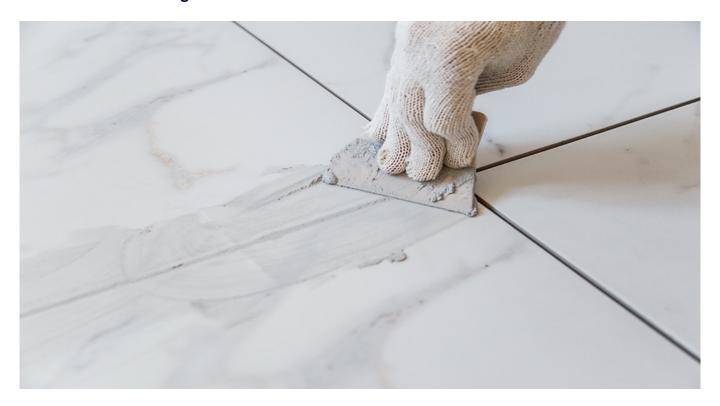**TECH OFFER**

# Automatic Tile Grouting Robot



## KEY INFORMATION

TECHNOLOGY CATEGORY:

**Infocomm** - Video/Image Analysis & Computer Vision
**Infocomm** - Robotics & Automation

TECHNOLOGY READINESS LEVEL (TRL): **TRL6**
COUNTRY: **SINGAPORE**
ID NUMBER: **TO174765**

## OVERVIEW

Tile grouting is the process of filling up gaps between tiles, after individual tiles have been laid onto cement screed and is a critical part of virtually every construction project. Yet, it remains a highly laborious process, and is considered one of the most physically demanding tasks as it often results in injuries to tilers' knees and back. This, in turn, leads to quality issues when grouting is not performed correctly. The construction labour shortage in Singapore, especially in the tiling/construction industry has likewise catalysed the demand for automation of such jobs - especially since such tasks are deemed to be less desirable to a younger generation of workers.

This technology offer is a tile grouting robot powered by Computer Vision (CV) and Simultaneous Localisation and Mapping (SLAM) techniques, running on Robot Operating System (ROS2) to boost construction productivity and reduce the occurrence of workplace injury. The robot is able to boost productivity by at least 5 times and this results in an amortisation time of roughly 24 months.

## TECHNOLOGY FEATURES & SPECIFICATIONS

This technology offer is a compact, precise, battery-powered grouting robot that runs on Robot Operating System (ROS2) that has the following features:

- Grout canister with specialised nozzles to dispense and grout directly into tile gaps
- Grouting mechanism enables grout both centre and corner lines
- Self-cleaning mechanism (sponge belt) to clean up any excess grouting
- SLAM techniques to automatically map out a room in real-time via two-dimensional (2D) Light Detection and Ranging (LIDAR)
- Recognise grout lines via a downward-facing camera with sub-millimeter precision, additionally, computer vision based detection of doors, steps, pipes and holes not visible to 2D LIDAR

Grouting can be performed in any given space, including irregularly shaped rooms/corridors. Human intervention is only required to assist the robot to traverse between floors within the construction site, to re-fill the grout canister, change grout colour (if the next room has a different grout colour), and to manually fill up tile gaps that are obstructed behind pipes/objects that the robot cannot physically get to (though such cases are limited)

The battery life on the robot lasts for an operating duration of 5 hours, across a floor space of 60sqm.

## POTENTIAL APPLICATIONS

This technology can be deployed to automate the tile grouting process for the flooring/tiling industry while the technology stack that the robot operates on can also be applied for other applications within the construction industry, such as:

- Tile laying
- Floor cleaning
- Quality assurance/quality checks
- Autonomous data collection (when outfitted with a range of sensors e.g. noise, temperature)

## UNIQUE VALUE PROPOSITION

Compared to machines/tools which are already available to aid the tile-grouting process, but still require human operation/intervention, this tile-grouting robot is autonomous and automates this laborious task. This purpose-built robot operates at a significantly lower bill of material cost when compared with non-purpose built arm effectors from large robotic manufacturers which cost more than USD$50,000 (excluding other essential sensors/components specific to a particular application)

The technology owner would like to work with construction companies and tiling companies for test-bedding opportunities. Additionally, construction-related companies such as grout manufacturers, material supplies, and tool manufacturers are also of interest for potential R&D collaboration and co-development opportunities.