

# Industry Revolution 4.0 Digital Waste Management Platform



IR4.0 digital waste management platform was developed by Swinburne researchers as well as students. Students were exposed to real-world working environment and trained to boost their confidence and competency in solving complex problems. Students have witnessed how waste management can be revolutionised based on their innovation imparted into the project. Students interact directly to their stakeholders within and outside Trienekens including garbage collectors, garbage truck drivers, administrative officers, as well as managerial personnel to identify the pain points and opportunities of the industry. Students learned enterprising skills via such interaction with their stakeholders. With mentorship from researchers, students are trained to find solutions to solve those pain points by involving themselves into the waste management operation. They appreciate how 3D (Dull, Dirty and Dangerous) career in waste management can create positive social impact in upholding clean and hygenic living environment in Smart City.

Swinburne researchers developed Industry Revolution (IR) 4.0 solution into Trienekens waste management that will transform the waste management industry in Sarawak. Swinburne research team developed innovative smart bins and decision-making system for Trienekens. Smart bins that are connected to decision making system seamlessly via telecommunication network. Data such as garbage collection time, garbage weights, and truck garbage collection route are automatically collected. Big Data Analytics techniques are deployed to optimize the garbage collection processes. Artificial Intelligence and Machine Learning algorithms are designed to predict future waste management trend in term of waste category, tonnage, landfill, and mobility of human capital. For example, future household waste can be estimated

so that human capital and machinery investment can be planned far ahead to minimize investment. Novel AI and ML algorithms are being innovated and developed to classify recyclable waste from waste dump.



Sarawak waste management industry will be transformed based on the IR4.0 digital waste management platform. As early as infancy stage, there were already more than 80 household owners benefited from Swinburne-Trienekens-Kuching City Council consortium where garbage collection processes were fully digitalised. Currently municipal waste collection operations focus on emptying garbage bins based on fixed schedule. With the digital platform, efficiency of waste collection operations can be further enhanced by running elastic schedule that predicts full garbage bins and only send garbage collection truck to areas with the most number of full garbage bins. This is only possible when the digital platform provides route optimization and operations analytics that are powered by Swinburne's research team's AI and ML algorithms. Trienekens Sarawak has stepped up its engagement with Swinburne to expand footprint of the digital waste management platform. Innovative processing of satellite imagery has been conceptualised to identify illegal waste dumping locations on both land and water.

This engagement exhibits strong translation from research to social impact with absolute connection to business i.e. Trienekens, Industry i.e. waste management, and community i.e. every household in Kuching city. Trienekens Sarawak stays at the forefront of waste management industry as innovator alongside with Swinburne Sarawak as its creator.