MOVABLE ASSETS LOCALISATION WITHIN BUILDINGS USING REAL WORLD COORDINATES

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Robot Operating System | Digital Twin | Real-World Coordinates | Interoperability

WORLD CITIES SUMMIT
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BACKGROUND

Many robotics companies have their own proprietary systems for visualising robot movements within mapped environments and their individual systems restrict interoperability and collaboration among different robotic platforms.

RESEARCH GAP

To explore a methodology to integrate various movable assets onto a unified platform for collaborative visualisation within a 3D digital twin and address the challenge of movable assets navigation across multiple floors.

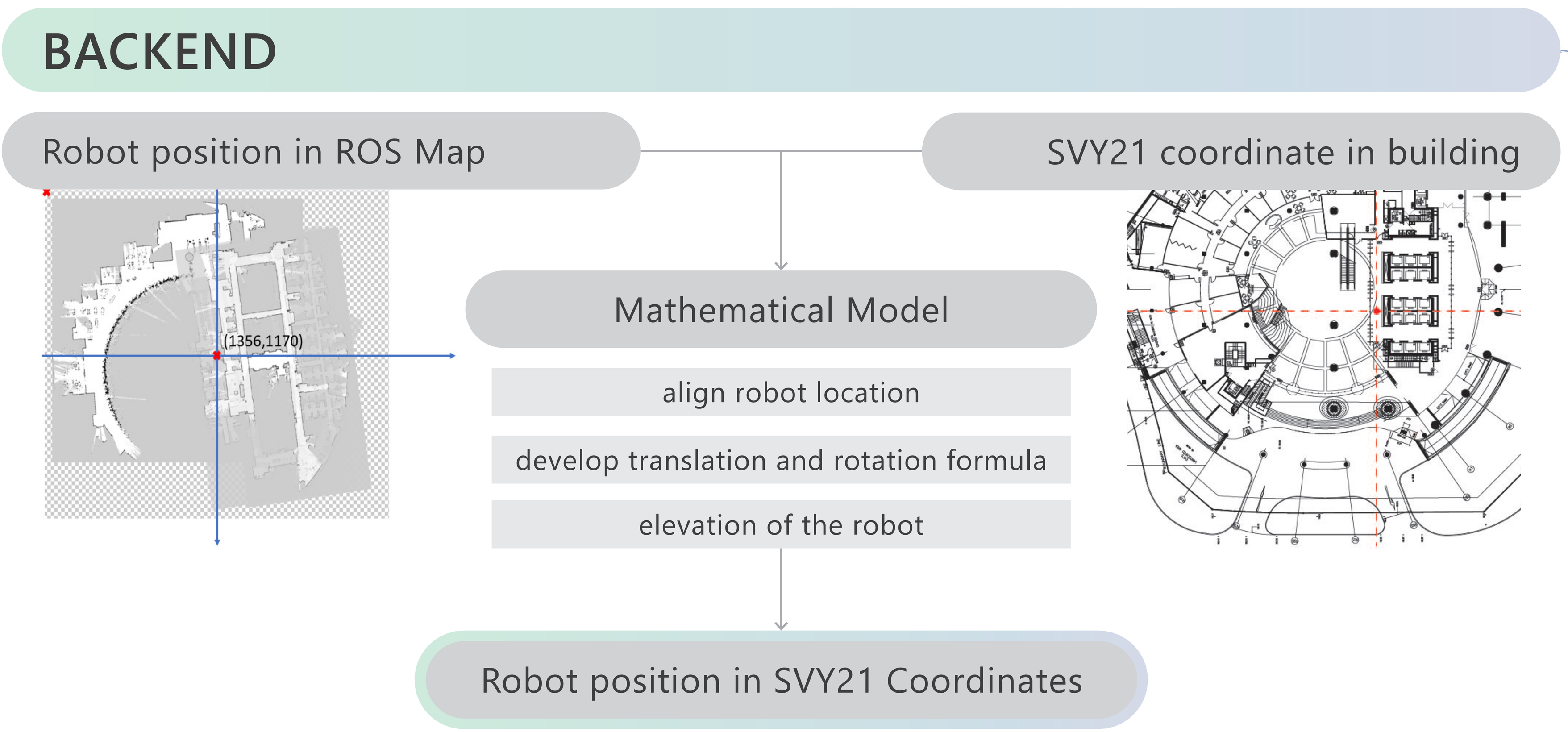
AIM

To support the development of a Digital Twin (Command, Control and Communication System) in JTC Summit, a 31-floor office building in Singapore.

For building owner, to gain better operational control and awareness of robotic operations in their building as well as to onboard robotic systems easily.

To better manage movable assets to serve its tenants and visitors, for instance, last-mile delivery of goods for tenants and ushering of visitors.

METHODS



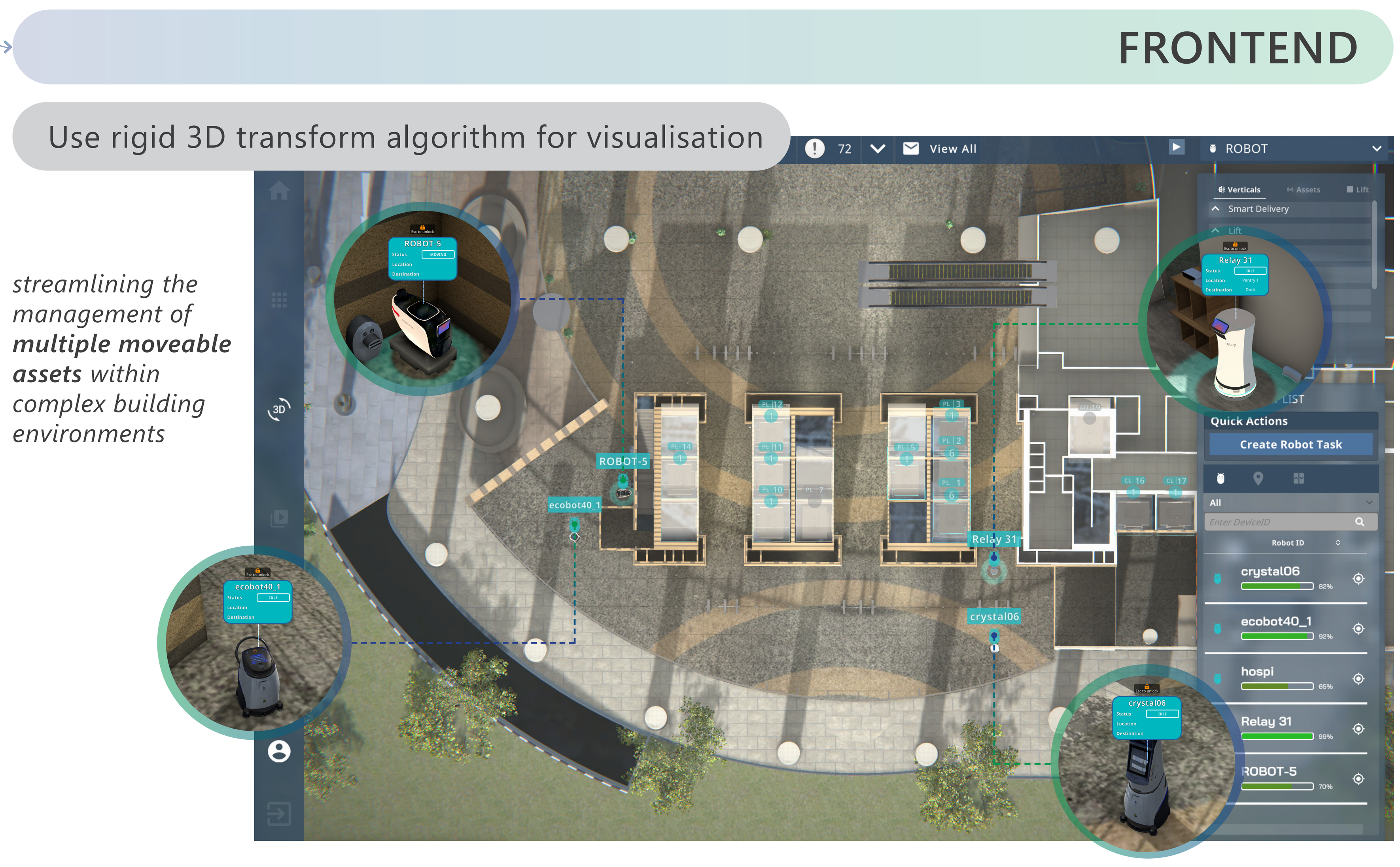
A mathematical model is used **to calculate the regression coefficient** for each ROS Map would have to be transformed to match the building floor plan along with the IMU data of the robot. The relationship between the dependent and independent variables can be determined so long as there is sufficient training data. The ROS map position of each individual robot can then be transformed and the corresponding SVY21 coordinate can be obtained.

This is done by combining individual ROS Maps onto the physical building floor plans, which are available in DWG format. The relative locations of each ROS map are thus defined and a new origin for each map can be set. After combining all the maps, the SVY21 coordinate of each ROS map can be identified, as each DWG file consists of geographic coordinate information.

FINDINGS

The intention of using real-world coordinates, such as UTM (Universal Transverse Mercator), WGS84 (World Geodetic System 1984), or the SVY21 localised datum system commonly used in Singapore, is to provide a reference frame for a centralised digital twin. The 3D visualisation environment of the Digital Twin allows the owner of the building to have a better view of the robot behaviour and actual operations.

Also, as 3D universal coordinates are used, there is the added advantage of doing away with the need for external infrastructure/sensors to track the robot position within the building, as the ROS map is already transformed into real-world coordinates.



CONCLUSION

This facilitates the tracking and traffic control capability of robots that are within the building, empowering the building owner to better manage movable assets to serve its tenants and visitors, for instance last-mile delivery of goods for tenants and ushering of visitors. The need for external infrastructure/ sensors to track the robots within the building is thereby removed, hence reducing the cost incurred by the building owner and facilitating the ease of set-up and robot deployment.

Additionally, the use of a unified real-world coordinate system would facilitate the deployment of robots in both outdoor and indoor settings, especially as robots enter and transit into different environments that would be monitored in a collaborative digital twin.

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