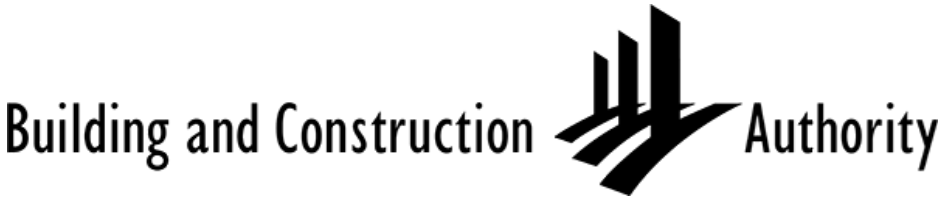
Info-communications Media Development Authority (IMDA)



Building and Construction Authority (BCA)

Requirements for Integrated Robotics and Automation Solutions for Built Environment sector

1. IMPORTANT NOTE

1.1 This requirements document must be read in conjunction with the information on Advanced Digital Solutions (ADS) at www.imda.gov.sg/AdvancedDigitalSolutions.

2. CALL FOR PROPOSALS

2.1 IMDA and BCA are calling for Participants to submit proposals to help enterprises, 80% of which must be Small and Medium Sized Enterprises (SMEs) in the Built Environment (BE) sector. The proposals should include solutions to streamline construction trade specific tasks and facilities management through digitalisation and Robotics and Automation, with the objectives of minimising physical interactions, reducing manual operations and integrating digitalisation into business operations.

2.2 These solutions should also enable Enterprises to sustain and transform their businesses amid the COVID-19 pandemic and prepare them to be more resilient in the long run.

3. BACKGROUND

3.1 Due to the ongoing COVID-19 pandemic with travel restrictions worldwide, businesses in the built environment face a shortage of workers resulting in delays in the construction of current projects. There is a greater need to build resiliency in facilities management as well. These factors drive BE firms to adopt innovation and technology to alleviate the manpower shortage and improve productivity on-site and off-site.

3.2 Innovation and technology provide opportunities to overcome the challenges faced by BE firms including:

3.2.1. **Reduce reliance on foreign labour**. Due to the COVID-19 crisis, there is a global shortage of foreign manpower due to travel restrictions. Adoption of autonomous Robotics and Automation solutions by BE firms can potentially help to reduce the number of manpower needed to carry out on-site and off-site tasks. Adoption of autonomous Robotics & Automation solutions by BE firms can potentially bring long-term, sustainable benefits to the firms and the BE sector as a whole.

3.2.2. **Increase productivity.** Robotics and Automation solutions have the potential to automate and speed up various labour-intensive tasks. Some examples of the tasks could include carrying materials and objects on-site, surveillance, and trade specific tasks like painting, drilling, facade cleaning.

3.2.3. **Increase safety.** Automating certain tasks such as carrying of objects and inspection of facades to potentially help to create a safer environment for those who work in the BE sector. Workplace injuries can be reduced, and we move towards a safer work environment for industry stakeholders.

3.2.4. **Increase adoption of digital solutions.** BE firms could use the adoption of robotics solutions as a milestone in their digitalisation journey. As Robotics and Automation systems rely on digital software, there are opportunities for BE firms to adopt digital software solutions to streamline and digitalise their processes and tasks under the Construction and Facilities Management Industry Digital Plan.

3.3 This proposal calls for technology solution providers to step forward with applicable Robotics and Automation systems integrated with digital solutions to improve current construction and facilities management related processes. At the same time, this would help to minimise physical interactions to avoid potential spread of COVID-19 virus.

3.4 IMDA and BCA aim to support technology companies (vendors) or consortiums that are able to deploy readily available **Robotics and Automation Solutions** to help enterprises in the Built Environment overcome these challenges, in a scalable and cost-effective manner.

4. REQUIREMENTS

4.1 **Robotics and Automation Solutions** should align with the Robotics for Autonomous Construction and Facilities Management solution category described under the **Construction and Facilities Management Industry Digital Plan**[1] Stage 3 that cover the following sub-categories:

4.1.1. **General Task Robotics** include autonomous material transporters and autonomous construction vehicles to be used in construction sites and/or factory environments. Other robotics tasks including autonomous installation of building components could be included in this category.

4.1.2. **Specialised Task Robotics** to aid in specific construction trade specialist areas such as finishes, painting, drilling, plastering, tiling and welding for on-site and off-site.

4.1.3. **Maintenance and Facilities Management Robotics** to be used in site and building projects. These solutions could include a wide range of applications for site inspection and maintenance that range from wall crawlers, site inspection, quality inspection and building facade clearing robots. For

[1] Refer to the document at https://www.imda.gov.sg/programme-listing/smes-go-digital/industry-digital-plans/Construction-and-Facilities-Management-IDP

facilities management in buildings, solutions could include single task and multi-tasks robots in operation & maintenance, environmental services, security, and landscaping.

4.1.4. **Drones** for aerial and underground remote surveillance, site and building inspections (e.g. facade, hard to access or confined environment). Preferred for the solution to be equipped with scanning technologies to map the surroundings for purposes for predictive maintenance.

4.1.5. **3D Printing Solutions** capable of on-site and/or off-site production of 3D printed building components. The integrated system should include an embedded digital software to design the building components, a 3D printer with robotic arm / gantry and nozzle to work with the selected materials.

4.1.6. **Other categories of Robotics and Automation solutions** which are not listed above but would be able to meet the requirements in 4.2.

**Note: Where Robotics and Automation Solutions that leverages connectivity means (e.g. wireless local area network, cellular, etc) for management/backend reporting/others, kindly ensure that it is conforming to the relevant ICT standards https://www.imda.gov.sg/regulations-and-licensing-listing/ict-standards-and-quality-of-service/Telecommunication-and-Security-Standards*

**Note: Where relevant or applicable, kindly ensure Robotics and Automation Solutions comply with prevailing government regulatory requirements e.g. CAAS requirements on UA regulatory requirements*

4.2 The proposed Robotics and Automation solutions must integrate with at least one of the following **Stage 1, 2 and 3 solutions** under the Construction and Facilities Management Industry Digital Plan (IDP). Other alternative digital core systems beneficial for construction companies not listed may also be accepted subjected to approval from IMDA and BCA. Some examples are listed below:

4.2.1. **Data and Artificial Intelligence (AI) – driven Decision Support System (Stage 3) -** Increase project predictability and performance through cumulative data collection, machine learning, and artificial intelligence. For example, drones can be used to capture BIM images for building facade inspection and monitoring. These images can be fed into the Data and AI-driven Decision Support System (IDP Stage 3 solution category) to identify defects and the BIM-to-Field solution (IDP Stage 1 solution category) to accurate record site information for better visualisation and compliance tracking with engineering designs.

4.2.2. **Integrated and Smart Worksite Monitoring and Inspection (Stage 2) -** Autonomously capture 360° images and video indoors or on challenging exterior sites. Frequently captured site progress snapshots can be contextualized in construction documents and used to automate insights. For example, the robotics solution can efficiently automate inspection tasks including providing visibility into hazardous places from afar (e.g. like gauge

reading, leak detection, thermal inspection, etc) using video analytics to proactively gather data to maintain and manage assets.

4.2.3. **3D Modelling, Immersive Visualization and Analysis (Stage 1) -** Collects real-time data for building high resolution 3D maps. These maps can then be uploaded into construction data analytics software or into BIM model comparison software. For example, the robotics solution can be set up anywhere in the construction site without a need for prior knowledge/maps. It navigates the site autonomously, without need for persistent communications to base and builds a map and collect data of the area as it scans. And then it returns to its base location autonomously, transfers data to a cloud for BIM model comparison and project report generation

4.2.4. **Building Information Modelling (BIM)-to-Field (Stage 1) -** Leverages BIM data to accurately determine where BIM-enabled robotic solutions could perform repetitive manual tasks on-site. A possible example would be used for overhead work such as drilling where, the robotics solution executes its tasks based on building information modelling (BIM) data, an easy-to-use system that does not require expert skills. It locates itself accurately indoors, drills the holes dust-controlled and finally marks them according to the trade. BIM-enabled robotic solutions also make the construction process more transparent with improved execution speed, constant performance and fewer errors.

4.3 Proposed Robotics and Automation solutions could possibly leverage BIM (building information modelling) information where possible.

4.4 In summary the proposed Robotics and Automation solutions (Stage 3 – Robotics for Autonomous Construction and Facilities Management) will need to offer the use case (e.g. On-site automated and robotic systems, drones, etc) that comes pre-integrated with features/functionalities as identified in Clause 4.2.

4.5 Solution providers with the relevant Robotics and Automation Solutions should also have the capabilities to provide technical support and servicing where required to users during the duration of the ADS project.

[End of Document]

