

Statement Number
 Launch Date
 Closing Date for Submission

2
 15 September 2023
 26 October 2023

Title	Cleaning toilets with minimal human intervention
Background	<p>Manpower shortage is common in the cleaning industry driven mainly by tight labour market and the challenges in attracting workforce into the cleaning industry due to the manual nature of works and especially so with the stigma associated with some of the cleaning works such as toilet cleaning. It is one of the main touchpoints which requires attention from the cleaning service partners to manually clean and top up consumables.</p> <p>While existing technologies in the market such as sensors may provide some level of situational awareness to enable users in changing their operations to cleaning on demand, it is unable to reduce the reliance of workers in toilet cleaning.</p>
Challenges	<ul style="list-style-type: none"> • The public sector owns a significant number of toilets that must be cleaned manually by our cleaning operators daily. • While we could remodel toilets to incorporate the latest technology solutions, such opportunities mostly occur when there are estate renovation and refurbishment (R&R) works (long intervals). • Manual cleaning sanitary fixtures (such as toilet bowls, urinals, and basin) is tedious, physically demanding to our pool of cleaners and the fixtures can vary across different estates and between buildings in the same estates.
Desired Outcomes	<p>The solution would allow the cleaning operators to perform other tasks while the technology solution takes care of cleaning with minimal supervision. When necessary, human intervention should be straightforward and easy for the cleaning operators to handle. The solution should also demonstrate a noticeable improvement in the cleanliness of the toilets.</p>
Requirements	<p><u>General</u></p> <ul style="list-style-type: none"> • Refer to NEA's COPEH (Code of Practice Environmental Health) and other relevant published guide/codes for considerations when designing and planning of the solution. • Includes a technology disclosure of Foreground Intellectual Property (FIP) as the final project deliverable in the payment schedule amounting to <u>at least 5%</u> of the lump sum payment. <p><u>Process</u></p> <ul style="list-style-type: none"> • The proposal should suggest a workflow that incorporates the solution into the cleaning operations and articulate the rationale. • It should also include a plan for engaging cleaning contractors. • It should also include details of how cleaners are involved in the workflow. • Possible exceptions or outliers in the cleaning process should be identified, and the solution should outline how it addresses them. <p><u>Solution</u></p> <ul style="list-style-type: none"> • should be designed to effectively address the varying types of toilets in the JTC stock. • should clearly outline the limitations and capabilities of the solutions being proposed.

	<ul style="list-style-type: none"> • Should explain why a specific toilet cleaning task was chosen for automation. • The method (the “how”) to automatically clean specific fixtures (such as sink basins, urinals, toilet bowls, cubicle frame, toilet floor and wall), as well as any necessary development, should be described. • Proposed solution ability to clean other sanitary fixtures should be detailed. • Should have provisions to assess and measure the cleanliness of the sanitary fixtures after cleaning. • The solution must address cross-contamination concerns between different cleaning tasks, such as the need for disinfecting before switching adaptors. • Provisions to study the considerations for maintainability of the proposed solution, then include it as part of the design (refer to additional info “<i>Design For Maintainability Guide Non-Residential</i>”). <p><u>If it is a robotic solution</u></p> <ul style="list-style-type: none"> • Should have reasonable operating hours between battery charges. • Provide target cost price of solution with detailed illustration of the cost breakdown. 																	
Possible Solutions	<ul style="list-style-type: none"> • Open to exploring robotics solutions, starting with the most challenging and unpleasant cleaning tasks before gradually expanding to: i) other tasks; and ii) potentially deploying across multiple toilets within the same floor and building. • Receptive to material applications that make cleaning easier and result in a noticeable increase in productivity. • <u>Not interested</u> in sensor systems that only trigger attendant to clean, as these are commercially available. We are focused on solutions that actively perform the cleaning task, not just monitoring. 																	
Development Timeframe	<p>Keep within 12 months, the below timeframe is for reference only</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Timeline</th> </tr> </thead> <tbody> <tr> <td>Onboarding workshop involving stakeholders</td> <td>by month 1</td> </tr> <tr> <td>1st prototype and trial to stakeholders</td> <td>by month 3</td> </tr> <tr> <td>1st round of refinement</td> <td rowspan="2">by month 6</td> </tr> <tr> <td>2nd prototype and trial to stakeholders</td> </tr> <tr> <td>2nd round of refinement</td> <td rowspan="2">by month 9</td> </tr> <tr> <td>3rd prototype and trial to stakeholders</td> </tr> <tr> <td>3rd round of refinement</td> <td rowspan="2">by month 11</td> </tr> <tr> <td>Final round of trial to stakeholders</td> </tr> <tr> <td>Final project review & technology disclosure</td> <td>by month 12</td> </tr> </tbody> </table>	Item	Timeline	Onboarding workshop involving stakeholders	by month 1	1st prototype and trial to stakeholders	by month 3	1st round of refinement	by month 6	2nd prototype and trial to stakeholders	2nd round of refinement	by month 9	3rd prototype and trial to stakeholders	3rd round of refinement	by month 11	Final round of trial to stakeholders	Final project review & technology disclosure	by month 12
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Evaluation Criteria	<p>60% quality of Proposal (scope of work, operational feasibility, disruption to operations, experiences and skills, cost benefit analysis, commercialisation and implementation plans); and 40% price (reasonableness of project cost and value for money, co-funding and contribution in-kind).</p>																	
Testbed/ Trial site (envisioned deployment site)	<ul style="list-style-type: none"> • Commercial & Office Space (JTC Summit, Jurong Town Hall) • Ramp up Factories/Industrial Flatted Factory (JTC Space @ Tuas, Surface Engineering Hub, Aviation One, Autobay Workshop, 3024A Ubi) • Eating House (45 Quality Road Eating House, Jurong Port Eating House) <p><i>Note: Proposed sites are subjected to changes.</i></p>																	

Payment model	<i>Fixed priced, payment by milestones</i>
Additional Info	<ol style="list-style-type: none"> 1. Refer to “Design For Maintainability Guide Non-Residential (Version 2.), Part II, section 4 O) Robotics & Automation” or most recent version in https://www1.bca.gov.sg/buildsg/facilities-management-fm/design-for-maintainability 2. Critical dimensions of toilet cubicle: 900mm wide and 1500mm deep, refer to “Code of Practice on Environmental Health” published by National Environment Agency (NEA) Singapore, or the most recent published version. 3. Annex A: Sample toilet floor plans