

## **Problem Statement/Title: Autonomous outdoor conservancy cleaning machine at turf and non-turfed areas**

**Desired Outcomes:** To develop a self-cleaning machine to clear litter and leaves from planter beds and thoroughfare to enhance productivity and efficiency of cleaners

### **Background of Problem:**

Litters and leaves in park and planter boxes have to be cleaned regularly by conservancy service providers at Mandai park to maintain a positive guest experience, minimise mosquito breeding and reduce fire hazards. Currently, two cleaners are deployed in the park on 8-hour shifts, who focus on clearing of litters and leaves in planter boxes.

The proposed solution must be able to clean litter and leaves in the park and planter beds autonomously, and be able to dispose of collected material without any manual assistance.

Currently, the clearing is done manually, which is time-consuming and labour intensive especially when leaves shed during the dry season.

While sweeper machines have been explored, there are limitations due to the inflexibility of the machines. Current machine limitations include:

- *Unable to clear leaves if it is wet (after rain)*
- *Unable to manoeuvre in slopes and steps due to multiple terrains in the park*
- *Unable to run for a long period of time*
- *Debris collected often jam the machine, which requires manpower to rectify*
- *Only able to clear planters less than 1m away from the walkway*
- *Not weather proof*
- *Ineffective in clearing of leaves and planters (manual process is faster)*
- *Ineffective motion sensors*
- *Too noisy*
- *Draws up too much soil*

As such, there is a need for an assistive solution to automate the outdoor conservancy cleaning for turf and non-turfed areas.

### **Technical Requirements:**

- The proposed solution must be functional in a natural environment exposed to both rain and shine (weatherproof)
- The proposed solution must be functional in varied terrains, such as steep slope, uneven terrain, steps, roads, pebble wash and mud finishing, etc.
- The total power consumption of equipment(s) must not exceed power supply allowable in the premise as it may cause a power trip. QP/LEW is to certify that the installation of the system is safe for the purpose of trial

- The proposed solution needs to operate for at least 4 operation hours for every 2 hours charging duration
- It should automatically move to the designated area for cleaning from the charging point. The device's location should be tracked during operation for security purpose, and it should be able to return to the charging point by itself.
- The proposed solution is required to work during both the day and night. The proposed solution must be able to sense any motion (animal; human; vehicle) and avoid them during operational hours.
- The proposed solution must have minimal noise generation and minimal soil suction in the planter beds. Soil suction to be less than 5% of total debris collected
- The proposed solution must be able to dispose collected material to the bin center without any assistance
- Size of equipment to be no bigger than 150cm (L) by 115 cm (B) by 115cm (H)
- The proposed solution must be waterproof and be able to clear planters of leaves and litters away from the walkway
- The proposed solution must be less time consuming and labour intensive compared to manual cleaning, thus reducing the number of manpower for cleaning
- There should be a collection of data on weight of collected items
- It should allow integration with other systems when/if required
- It should be easy to operate with no supervision
- It should be able to withstand impact such as a fallen tree branch

#### **Timeframe for development of proposed solution/product**

1. Completion of working prototype ready for evaluation 6 months after the start of project
2. Trial of working prototype with solution adopter for 3 months
3. Provide reports and findings on data collated during trial phase
4. Completion of full functional end product ready for pilot deployment 10 months after start of project

#### **Requirements of prototype**

It should meet all the requirements mentioned in the technical requirement specifications

#### **Market Potential for proposed solution/product**

- Applicable in all park settings such as attractions and nature reserves