A System for Watering and Autonomously Monitoring Plants

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PROJECT OVERVIEW

People enjoy having plants in their homes. However, caring for plants can be challenging and often results in unhealthy or dead plants. Several systems exist to help plant owners manage their plants, but these systems fail to accommodate personal plant care preferences. To provide a comprehensive solution, GRL PWR developed SWAMP, a mobile robotic System for Watering and Autonomously Monitoring Plants. SWAMP will replicate the plant care a human provides with minimal user input and allow plant owners the freedom to keep their plants anywhere.

CORE STAKEHOLDER NEEDS

1) Decrease the amount of work required to take care of household plants.

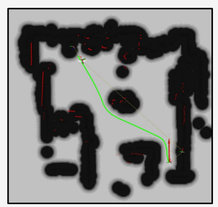
2) Access plants in a variety of common household locations, while avoiding obstacles.

3) Provide the correct amount of water for a diverse set of plants.

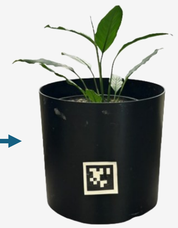
4) Operate with minimal user intervention and maintenance.

NAVIGATING

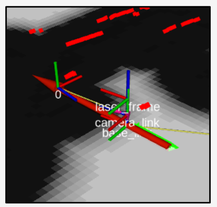
To allow users the flexibility in plant placement the robot will be a mobile system.



Path plan to plant locations identified on the map.



April Tags are used for plant identification and precise alignment.



Transform tag from camera frame to robot frame for alignment.

PROVIDING WATER

To dispense the correct quantity of water for each plant:

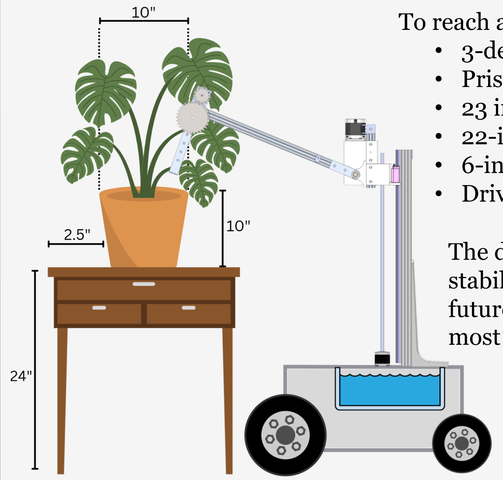
- Two hoses
  - Spray Nozzle
  - Mist Nozzle
- Two water tanks
- Brushless DC Motor Pump
- Moisture Sampling

The custom watering time for individual plants is based on the height of the plant, the volume of the pot, and the desired moisture level.

VALIDATION

To evaluate the robot's performance in a real-world environment, GRL PWR demonstrated the system in the WPI Gordon Library. To validate the system's functionality, SWAMP watered several plants located at a variety of heights in the café section of the library.

REACHING PLANTS



Design Scenario

To reach at least 70% of plants:

- 3-degree-of-freedom arm
- Prismatic-rotation-rotation
- 23 inches of vertical travel
- 22-inch shoulder link
- 6-inch wrist link
- Driven by stepper motors

The design's compactness, stability, and scalability for future iterations made it the most effective option

FUTURE WORK

1) Increase the vertical height of SWAMP to reach more plant locations.

2) Implement a docking station for autonomous recharging and water refilling to reduce the work for the user to maintain the system.

3) Expand plant health monitoring factors with visual assessment tools to include leaf color, wilting, or seasonal requirements.

4) Improve user interfaces to allow the user to easily configure the robot for autonomous care.

ACKNOWLEDGMENTS

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