A UAV Platform for Mass Production of Control Crosses in Loblolly Pine

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INTRODUCTION

- Controlled pollination is accomplished by isolating female strobili using bags.
- Installation of bags, injection of pollen, and removal of the bags is done manually using aerial work platforms.
- Using an unmanned aerial vehicle (UAV) platform for injecting pollens will be a safer, faster, and less expensive alternative.
- The market for the best seeds is in excess demand and in need of innovation for increased production.

DESIGN

Bags such as this one are commonly used for isolating flowers, but not with QR codes and fiducial markers.

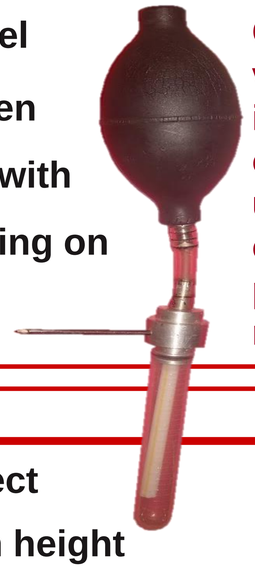
In the proposed UAS:

Markers are used for bag pose estimation.

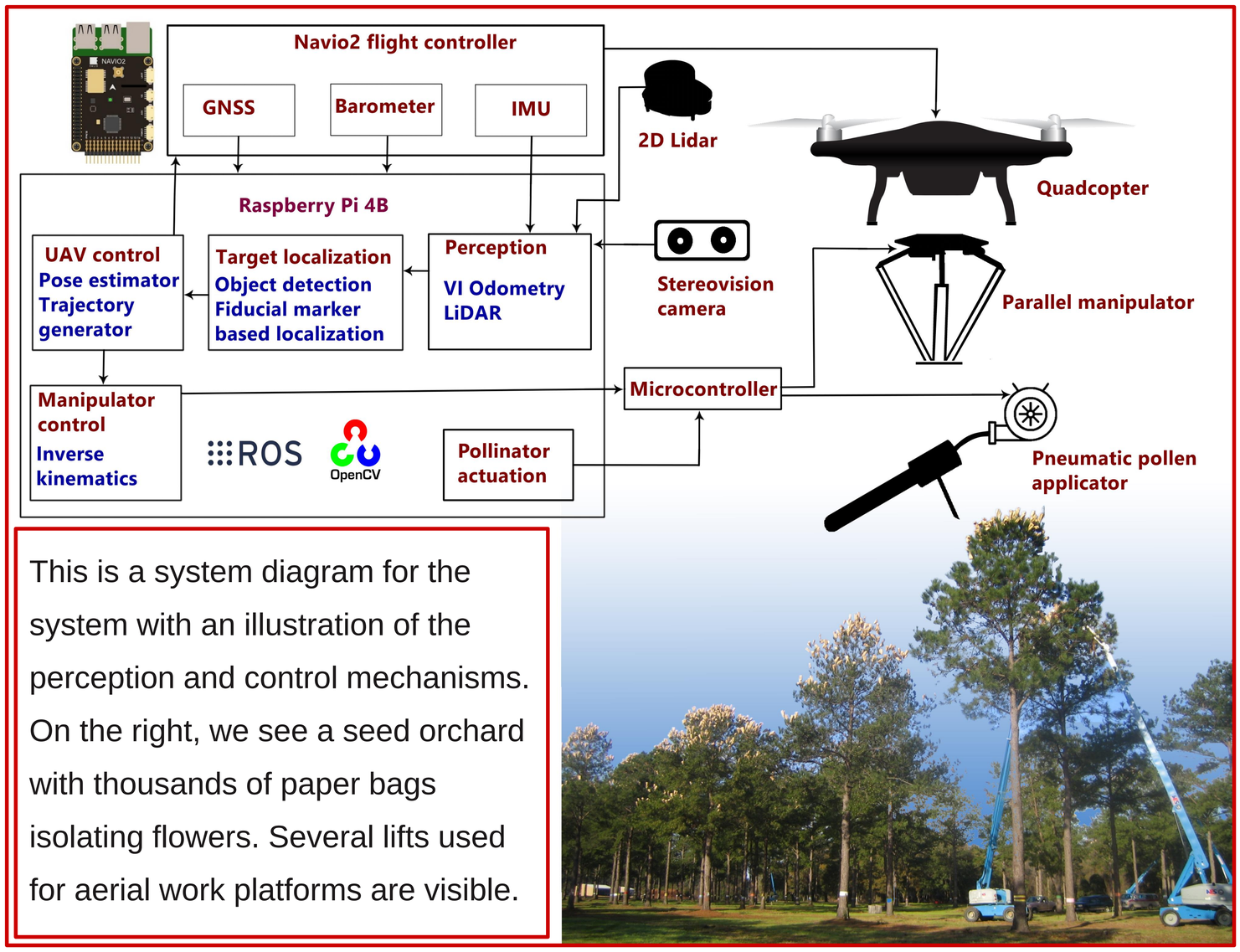
QR codes are used for bag identification and database management.

2 million bags are placed each year for producing control crosses of loblolly pine in the Southeast US. 173 million seedlings of specific crosses were planted in 2019.

The system uses a novel pollinating device. Pollen injection is carried out with a pneumatic device acting on the cyclone injector.



Cyclone valve injector currently used in control pollination research



This is a system diagram for the system with an illustration of the perception and control mechanisms. On the right, we see a seed orchard with thousands of paper bags isolating flowers. Several lifts used for aerial work platforms are visible.

OPERATION

1. Use 2D Lidar to detect obstacles and attain height over the canopy
2. Detect bags using stereovision camera; create map
3. Plan trajectory to unpollinated bag, fly to target using VI odometry
4. Direct manipulator to penetrate bag
5. Inject pollen in the bag, update pollination status of flower in the map
6. Repeat for unpollinated flowers

FUNDING INFORMATION

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