

Automated Tree-Shaping Drone

Senior Design Project

Coach:
Dr. Fahad Alam



INTRODUCTION

Automated tree-shaping drone for huge landscapes and parks is designed to decrease tree shaping time and boost efficiency while minimizing the labor costs. The drone utilizes a brushless DC motor held to a 3D-printed hinge for the cutting mechanism, as well as a camera connected to a processor for real-time tree detection process.

PROBLEM STATEMENT

Shaping trees using manual workers is slow and inefficient. The automated tree-shaping drone will fully automate tree shaping while considering the weight constraints and reduce the number of labor workers needed. This will save time and costs and ensure consistency.

CONSTRAINTS

- Drone should handle payload weight
- Cutting mechanism should be able to cut small branches
- Power supply sufficient for the DC motor
- Trimming time < Average manual worker (10-15 mins)
- Load value of at least 3kg

TARGET SPECIFICATIONS

- A 150 Watts-h battery lifetime
- DC electronics should meet the specifications of processors
- DC motors with angular velocity around 3500 rpm
- A 30fps camera for machine vision to detect trees

PROJECT IMPACT

The project will revolutionize the tree shaping industry by providing an autonomous solution to tree shaping in large parks and gardens that is more efficient than manual labor. The tree shaping drone should decrease the long-term cost of maintaining a set of trees and make it a less demanding process.

PROTOTYPE DESIGN

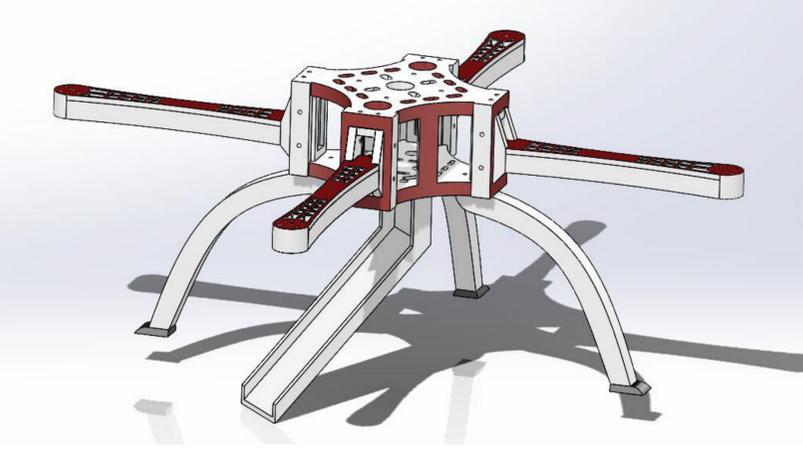


Figure 1: Prototype design

Prototype is divided into 3 parts:

1. The drone: a drone that could handle the payload weight
2. The cutting mechanism: shaping device consisting of strings similar to weed eaters, with added carbon fiber bits
3. A processor connected to a camera that runs the CV algorithm for tree detection

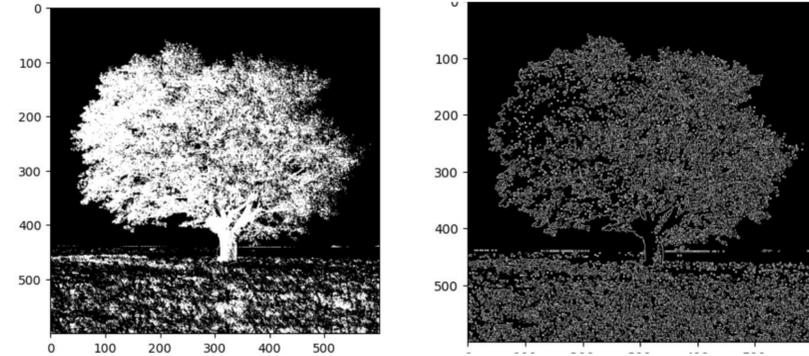


Figure 2: Edge detection

TESTING



Figure 3: Computer Vision prototype

CONCLUSION

In summary, developing a drone for tree shaping offers significant advantages. It promises precise and efficient tree maintenance, saving both time and money for parks. It ensures safety and convenience for park staff and visitors alike, enhancing the overall experience and upkeep of the park environment.