Abstract

Pilobolus and *Viola* inspired Precision-based Seed Dispersal Device for Efficient Forest Restoration

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INTRODUCTION

Afforestation and reforestation (A/R) serves as the crucial cornerstone for SDGs achievement, effectively reversing climate change and curbing desertification. Drone-supported seed sowing (UAVsSS) represents a paradigm shift in rapid forest restoration, surpassing conventional methods [1]. However, the exploration of more advanced alternatives is necessitated by certain limitations, including a low seed survival rate (0-20%), sensitivity to high wind and precipitation, concerns about seed-firing accuracy, and adherence to country-specific aviation rules [2]. Biomimetics, drawing inspiration from nature's time-tested design for resilience, stands as the contemporary answer for complex design problems. The objective of this study is to design an inventive solution for accomplishing forest landscape restoration, guided by the principles of biomimetics.

MATERIALS AND METHOD

Deriving inspiration from the phototrophic spore dispersal of the *Pilobolus* fungi, ballistic seed dispersal in Sweet Violet (*Viola odorata*) pods, and the adaptability of spiders in forest ecosystems, a sensor-based seed dispersal device has been designed. It is equipped with a GPS locator, light sensor, obstacle, and water surface detector. The device contains two seed chambers with native tree seeds of heliophytes and sciophytes. By constantly detecting sunlight penetration while moving on the ground, it disperses heliophyte seeds where sunlight penetration is more, and sciophyte seeds in relatively shaded zones. With spider-like maneuverability, it can navigate forest clearings, overcome obstacles like fallen trees, and even swim through water surfaces. Testing is conducted to assess its effectiveness in a simulated environment.

RESULT

Simulation demonstrates the device's adeptness in responding to varying light penetration and circumventing obstacles. The device accomplishes targeted seed dispersal based on detected

light penetration by mimicking the natural dispersal behavior of Pilobolus fungi and *Viola odorata* effectively.

CONCLUSION

The results indicate that this device presents a viable alternative for UAVsSS, providing an efficient solution for precision-based rapid afforestation.

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