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**Evaluation Form – Technical Background Review**

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**Team Name:** Drones Trimming Trees

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\_\_\_\_\_ / 30      Technical Content

- Current state-of-the-art and commercial products
- Underlying technology
- Implementation of the technology
- Overall quality of the technical summary

\_\_\_\_\_ / 30      Use of Technical Reference Sources

- Appropriate number of sources (at least six)
- Sufficient number of source types (at least four)
- Quality of the sources
- Appropriate citations in body of text
- Reference list in proper format

\_\_\_\_\_ / 40      Effectiveness of Writing, Organization, and Development of Content

- Introductory paragraph
- Clear flow of information
- Organization
- Grammar, spelling, punctuation
- Style, readability, audience appropriateness, conformance to standards

\_\_\_\_\_ / 100      **Total - Technical Review Paper**

# **Mounting a Trimming Device to a Remote-Controlled Drone**

## **Introduction**

With Pacific Gas and Electric being found responsible for many of California's wildfires, including Camp Fire [1]. Other power companies are prioritizing and optimizing their transmission line maintenance. This technical review briefly summarizes some commercially available drones and potential tree trimming devices to help Florida Power and Light design a droned tree trimming device that will cut down cost of transmission line management.

## **Current Solutions**

The current method of maintaining vegetation around powerlines is to have a crew of men take equipment to reach and clear any vegetation. In severe cases, a helicopter is piloted dangling a gas driven series of circular blades to clear large areas.

## **Commercially Available Blades and Saws**

The first design to be tested is based off of that of Jamie Hyneman's [2]. It is a servo motor (0.06kG) [3] driving a lopper head (0.998 kG) [4]. This will be a light and cheap design. The motor costs \$36.99 on Amazon [3] and the blade costs \$19.97 from HomeDepot.com . This design allows for a cutting capacity of 1.5 inches in diameter [4]. The alternative and more versatile second design consist of mounting a bandsaw to the drone. This design allows for cutting capacities of at least 2 inches with the capability of higher with only minor modifications. This increases total weight from 1.058 kG to 2.994 kG and total cost from \$56.96 to \$169.00 [4]. This upgrade also increases the ease of use of the final product. The blade is much easier to position while flying the drone rather than trying to place the targeted branch within the loppers. Jamie Hyneman had to weld a piece of wire onto the end of his loppers to allow for a guide to getting the branch inside the blades.

## **Drones Carrying Capacities**

The Matrice 600 PRO has a lifting capability at 5.5-6 kg, depending on the batteries used. The price of this drone is \$5,699 [5]. The Typhoon H Plus can lift 2 kg at a price of \$1,899.99 [6]. The DJI Spreading Wings S900 Drone can lift 4.9 kg at a price point of \$3606.72 [7]. The weight to price ratio gets very steep when approaching 2 kg. After analyzing these values, Drones for Tree Trimming is scheduling a meeting with FPL to assess what their specific needs and requirements of this project are, as well as determining their price range.

## **Cost Justification**

The drones needed for the large carry capacities can be justifiably purchased. This is because they will serve many other functions than just tree trimming. By making the blade or saw an attachment, the drone can still be utilized for its original functionalities. Having a high end, multipurpose drone will allow for less money to be spent flying helicopters to observe and inspect transmission lines. Isaac Bruns mentions, “An average contract for a helicopter power line inspection cost more than \$4000 per day,” [8]. Meanwhile, these high end drones are capable of performing closer inspections with AI stabilization and zoom features.

## References

- [1] Penn and P. Eavis, “PG&E Pleads Guilty to 84 Counts of Manslaughter in Camp Fire Case,” *The New York Times*, June 16, 2020. [Online], Available: <https://www.nytimes.com>. [Accessed Oct. 6, 2020].
- [2] C. Colin, “How Mythbuster Jamie Hyneman Hacked a Drone to Trim His Trees,” *Popular Mechanics*, 14-Nov-2017. [Online]. Available: <https://www.popularmechanics.com/flight/drones/a26102/jamie-hyneman-drone-plants/>. [Accessed Oct. 6, 2020].
- [3] *Amazon.com*. [Online]. Available: <https://www.amazon.com>. [Accessed Oct. 8, 2020].
- [4] *HomeDepot.com*. [Online]. Available: <https://www.homedepot.com>. [Accessed Oct. 8, 2020].
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- [6] *Yuneec.com*. [Online]. Available: <https://us.yuneec.com/typhoon-h-plus-drone>. [Accessed Oct. 8, 2020].
- [7] *HobbyKing.com*. [Online]. Available: [https://www.hobbyking.com/en\\_us/](https://www.hobbyking.com/en_us/). [Accessed Oct. 8, 2020].
- [8] I. Bruns, “Drones for Power Line Inspections,” *UtilityProducts*, Jan. 1, 2019. [Online]. Available: <https://www.utilityproducts.com/line-construction-maintenance/article/16003823/drones-for-power-line-inspections>. [Accessed Oct. 9, 2020].