Designing a Drone-Based Sensor Deployment for Improved Forest Monitoring

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Within forest ecosystems, there is a need to collect real-time data on insect outbreaks, disease outbreaks, wildfires, pollution, and climate change impacts. Engineers have used systems, such as drones, to carry sensors into these forests. However, a lightweight system does not yet exist for a drone to accurately place a sensor on the trees. To solve this problem, designs for a launcher and a sensor projectile were sketched in an engineering notebook. Using newly learned SOLIDWORKS software, the sketches were transformed into CAD files. The first iteration of a prototype included seven parts that were 3D-printed and assembled. After several other design iterations were considered, four complete prototypes were produced and tested using video analysis to determine the best launcher design. The prototype launcher that was attached to the drone weighs 177 grams and includes a continuous 35KG servo motor that compresses a 30-Newton spring. The launcher draws its power from the drone's battery. Once the spring is fully compressed, the gear connected to the servo slips, causing the spring to force the tread slider forward, which autonomously launches the projectile. Three launch angles tested from the horizontal plane were analyzed. From the data collected, the 30-degree launch angle was determined to be the best, with the projectile traveling 5.0046 meters per second with a 0-degree impact distance of approximately 1.1 meters. This satisfies the project goal of designing a lightweight, durable launch and projectile mechanism that can be attached beneath a drone to accurately place sensors on trees.