Draco Lizard-Inspired Robot for Structure Collapse Search

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Abstract

Scenes such as active fires and building collapses require precise response tactics in order to minimize risk to first responders and victims alike. Specifically, engineering robots to perform reconnaissance and relay critical information could greatly mitigate the risk posed to first responders entering dangerous scenes. My aim is to design a robot that possesses the gliding and crawling capabilities of the draco lizard. My goal is to incorporate this gliding system into the robot, enabling it to be deployed to disaster sites with ease and reducing the workload for first responders. Equipped with cameras, the robot will be able to relay footage of the disaster scene for monitoring. Additionally, a thermal sensing system permits the transmission of quantitative data on potentially hazardous conditions, aiding in the locating of victims and ensuring informed and safer rescue operations.

Background

Excluding deaths that resulted from 9/11 response, 83 structure fires took the lives of 112 firefighters between 1994 and 2013 [1]. These fires compromise the structure of buildings, often making it unsafe for firefighters to enter and conduct search and rescue operations. These scenes are quick to progress and it is usually the case that recon cannot be conducted due to the danger posed by the scene, giving firefighters no option than to enter blind. Major loss of life can be prevented by utilizing robotics to conduct recon for structure fire incidents. The draco lizard is the ideal model for this robot because its unique gliding capabilities, energy-efficient locomotion system, and abilities to harness these traits in a compact body [2].

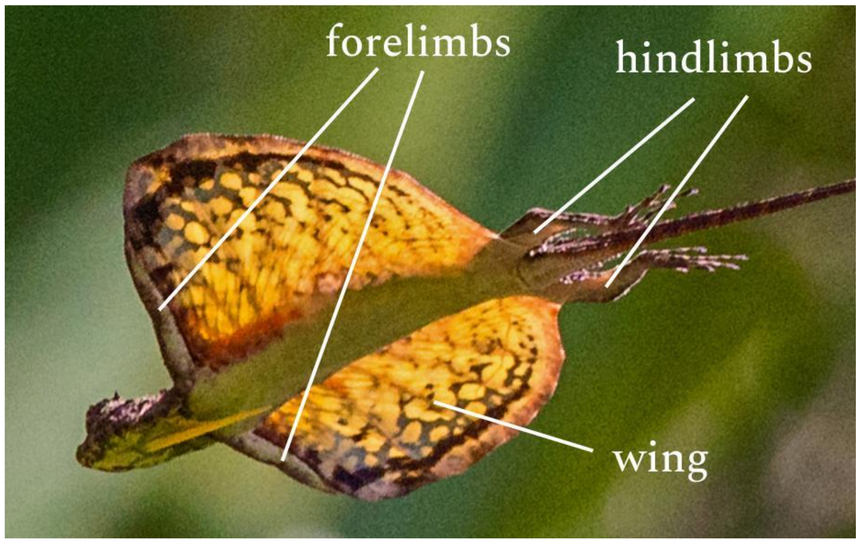

Figure 1. Draco Lizard Diagram [3]

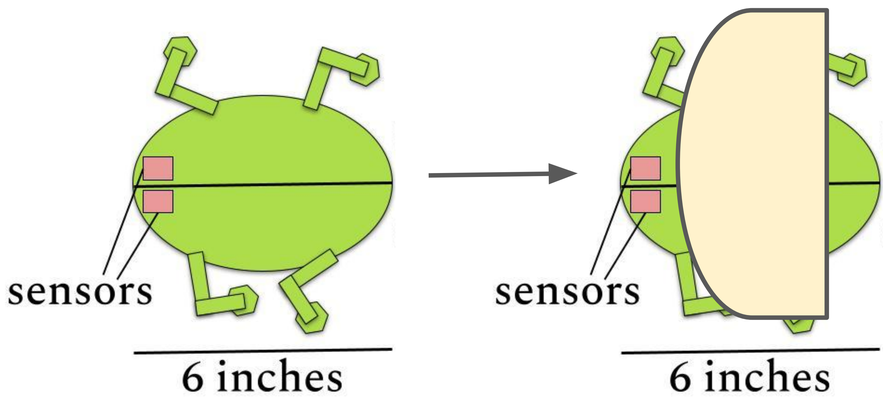

Figure 2. Initial Robot Design.

This figure models the initial design of the robot, including the outward folding mechanism and locomotion system. Once the glider is activated, it will be held open by the weight of the two halves of the body hanging below the glider.

Design & Methods

The robot will be no bigger than 6x6 inches to navigate rubble and obstacles. The design will incorporate an outward folding mechanism in the body that activates the glider. The locomotion system will be programmed in Arduino and modeled after the quadrupedal movement of the draco lizard, with opposite diagonal limbs moving simultaneously [4]. Cameras and thermal sensors will be attached to the body of the robot and relay information in real time. The robot body will be constructed using CAD software and 3D-printing. The glider will be made from a light plastic such as nylon.

Future Work

My future work will rely on the engineering design and iteration process. I will start by modeling my design using computer-aided design. The parts will then be printed out using a 3D-printer. I will assemble my robot with the glider and test the outward folding mechanism. Once I've critiqued the body and assembly, I'll be able to wire the electronic system to allow the glider to activate on command, and allow the robot to move in accordance with the Draco lizard locomotion system. This will all be done using Arduino. In terms of electronic hardware, I plan to use an Arduino Nano to minimize the space taken up by the electronics system, since the robot is tasked with navigating unstable obstacles. The electronics system will consist of motors for the robot limbs, a thermal sensor, and a camera. Both the camera and thermal sensor will be positioned at the head of the robot.

References

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