Robot Dragonfly

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About :

We aim to build a aircraft that mimics a dragonfly, which is equipped with two independent pairs of wings. We aim to develop a pair of flappers to reproduce the wing kinematics of dragonflies in hover and forward flight. If feasible a camera would be integrated with this model .

Learning objective:

In this project we aim to explore the aerodynamics of ornithopter . we are also aiming at learning the electronic chip making and understanding its functions. Through this project we are bound the explore the different aeromodels and design our own model by studying them.

Motivation:

We wanted to improvise the survillence and airborne photography which on appropriate development would (we believe) be a great boost in military survillence. The main problem with current spying devices are their sizes and starking robotic resemblence but the dragonfly we aim to built is of approximate palm size and are appreciably identical to actual dragonfly .

Broad vision:

The dragonfly's flight performance far exceeds many other flying insect species. The high level of dexterity in wing motion of the dragonfly allows it to hover, fly fast forward, make turns rapidly, fly sideways, and even glide. A dragonfly-inspired robot would potentially exhibit superior flight performance than existing designs of insect robots. The dragonfly robot, if given camera capability will find use in aerial photography, security and surveillance as it will be indistinguishable from an insect in the environment and will camouflage easily.

Project details : * this is a very broad vision of requirements. We would be using some of these mentioned parts .

-Parts involved:

:Carbon fibre rod for wings strength

:Mylar film for lift and thrust

:Delrin internal frame and Delrin miter gears

:Lithium polymer battery(250mAh)

:DC motors to drive the gears

:Expanded polypropylene will be used to make the central body

:Marc-Basic

:stereoscopic vision through dual cameras (if feasible)

:magnetic solenoidal actuators/Continuously Variable Transmission/double slider crank as actuators (any *one of the mentioned will be used according to availability.)

:3-axis accelerometer and a 3-axis gyroscope as is required for controlled flight through inertial guidance.

:ESC

:servos

Idea about implimentationof the project :

This model will be equipped with two pairs of independently controlled wings. The advantages of two separate pairs of wings are not only reflected in the increased total aerodynamic lift over one pair of wings, but also increased flight control inputs and stabilization techniquesin different flight modes.

The wing movement will be controled by either of the mentioned three mechanisms :

magnetic solenoidal actuators/Continuously Variable Transmission/double slider crank as actuators.

The wing movement has to be such that the two pairs are independent of each other. This will be achieved by separate gears for each wing pair. The phase difference between the forewing and hindwing is set by aligning the gears with the proper angular displacement.

Major focus will be on improvising the wings. . The completed wing will be aimed to weigh approximately 1.5 grams and was 6.25 inches long. The passive rotation joint was created from carbon fiber beams and tubes, which exhibited a very good stiffness to weight ratio. Lightweight wire was fed through the airframe and top plate to keep the posts (stainless steel rods coveredwith Teflon tubes) joining the two in constant compression. A Maxon RE 10 motor (capable of 0.75 watts) drivesthe Delrin miter gears

Timeline:

Week 1: understanding the design of similar dragonfly bots which have already been made , learning the wing pattern and aerodynamics from research papers

Week 2: deciding between alternative ways of implementing a chosen design based on efficiency and availability of parts (for ex. So far we have come across 3 ways of implementing wing flapping), buying the components needed

Week 3, 4: Implementation

Week 5: Testing

Demonstration: all the flight capabilities of the robot (take-off, gliding, flapping, counter-stroking, phase-stroking, synchronous-stroking) , camera capability if camera is used.

Skills: Solidworks, raspberry pi, basic introduction to aeromodeling

Competitions: we are hoping that we would get this project on board at various technical fests held across various IIT's and also try to commercialise it if possible.

Estimated cost: approx. 8,000

Acknowledgement/references: wikipidea, you tube, some research paper, https://www.youtube.com/watch?v=TDuvBurbjVU (project undertaken at other institue), https://www.youtube.com/watch?v=TDuvBurbjVU (research reference)