Redesign, Modelling and Simulation of an Unimotor Drone.

Tecnológico de Monterrey

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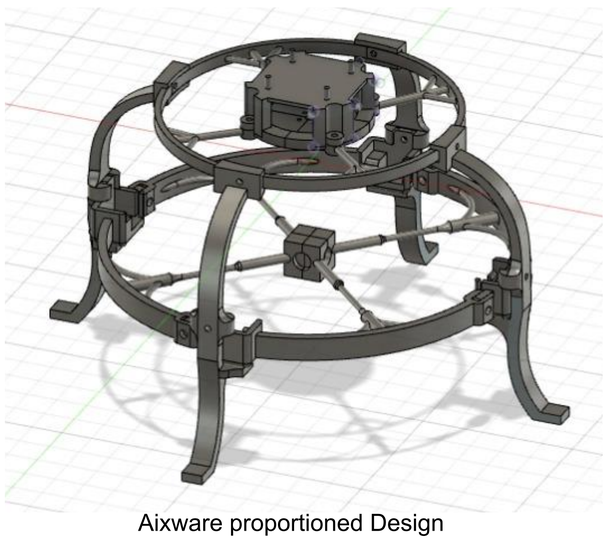
Introduction

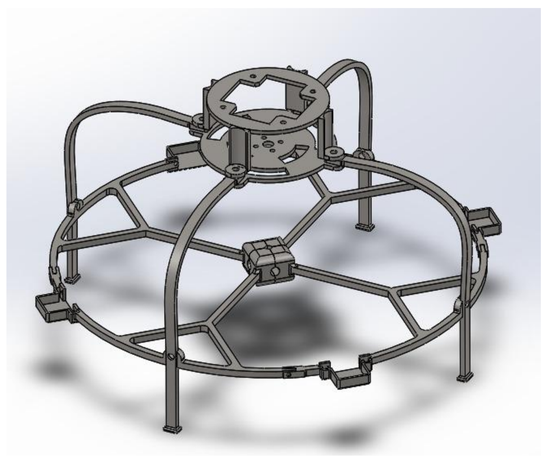
This project is aimed to design a functional Unmanned Aerial Vehicle (UAV) propelled by one DC motor and whose orientation and direction depends on the control of four fins. The project is based on the already mechanical and electrical design made by Aixware Technologies; however, this must undergo a mechanical redesign to improve its weight and flying capabilities. Moreover, as part of the control strategy programming and validation, a real time simulation is to be implemented through the use of Robot Operating System (ROS) and the Gazebo simulator.



Aixware proportioned Design

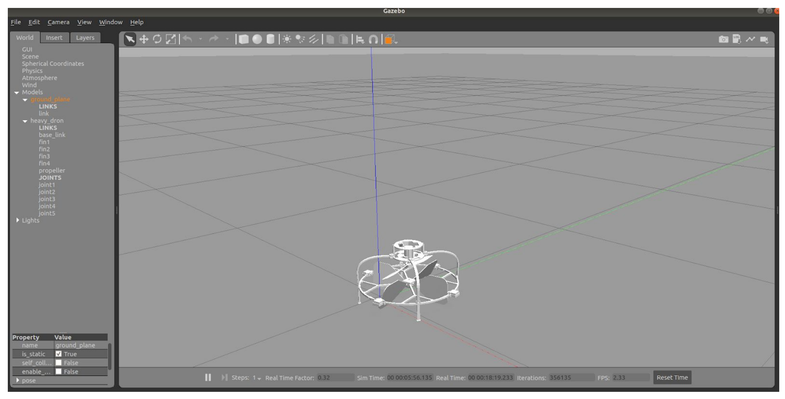
The final proposed design weights 805.4 grams, around 84% of the original drone's maximum weight.

This is the original drone design developed by Aixware, the chassis is made out of PLA and the fins from aluminium and carbon fibre, the whole structure weights around 959.66 grams with all the electronics set up.



Proposed Design

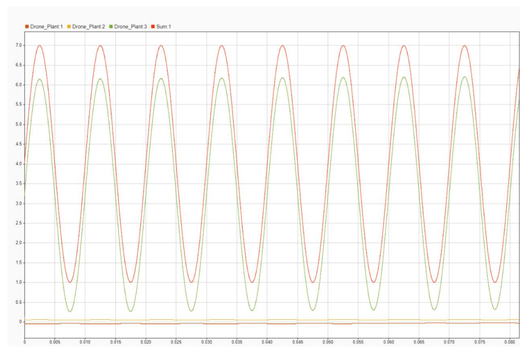
The final version of the drone was exported as an URDF model for the Gazebo simulation; the corresponding subscriber and publisher nodes were created also to communicate with the control model in MATLAB through the MATLAB's ROS Toolbox.



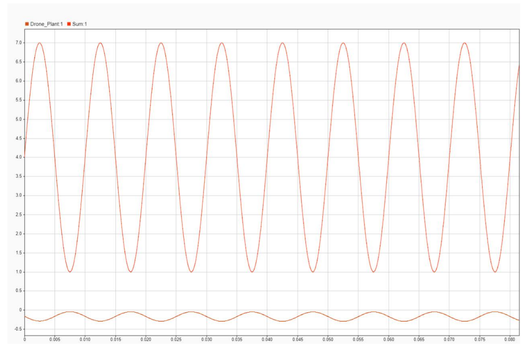
Drone in Gazebo Simulation Environment

Results

To test the robustness of our simulation framework, a sinusoidal path was individually introduced to each axis to see how the UAV responded in real time.



Sinusoidal Path Test-Z Axis from 1 to 7. Orange line: reference, Green line: UAV Z-Movement



Sinusoidal Path Test-X Axis from 1 to 7. Orange line: reference, Red line: UAV X-Movement

Acknowledgments

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Aixware Technologies
Departament of Mechatronics Engineering

Conclusions

A new single-engine drone design was developed based on the prototype provided by Aixware Technologies to achieve the goal of stabilizing the vehicle in mid-flight, meeting the electronic specifications of the first design.

A platform that simulates the behavior of the Drone's position in real time was implemented, this framework is based on the configuration between MATLAB and the ROS / Gazebo simulation and control environment.

Bibliography

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