e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:04/Issue:06/June-2022 Impact Factor- 6.752 www.irjmets.com

DYNAMIC FLIGHT CONTROL SYSTEM

Nandipati Prashant [*1], Varavara Sahithi[*2], Abdul Khaleel[*3] ,Dr.P.Satish Kumar[*4]

[*1]Student, Department of Electronics and Communication Engineering, ACE Engineering College, Hyderabad, Telangana, India.

[*2]Student, Department of Electronics and Communication Engineering, ACE Engineering College, Hyderabad, Telangana, India.

[*3]Student, Department of Electronics and Communication Engineering, ACE Engineering College, Hyderabad, Telangana, India.

[*4]Professor, Department of Electronics and Communication Engineering, ACE Engineering College, Hyderabad, Telangana, India.

ABSTRACT

The wastage of resource during a rocket launch is sometimes immense and the high expenditure of rocket launches have led to a system of reusable rockets, particularly, in the rocket's first stage. With the main objective of creating reusable rocket first stage, this project deals with automating the vertical Take-Of and landing (VTOL)Vehicles, which involves rocket flight controller and trajectory solvers for most optimal rocket path and landing. This project deals with simulating the said methods in standard control systems models like PID controllers and trajectory planning algorithms.

Keywords: Raspberry pi pico, creality Ender 3 printer, MK II design rendered, CAD solve space.

I. INTRODUCTION

A Flight controller is a device that manages and keeps a flying vehicle upright by controlling various thrust and control surfaces to balance a vehicle. This project deals with VTOL (Vertical Take-Off and Landing) vehicles such as rockets and active missiles. Vertical take-off and landing (VTOL) vehicles are a very primitive field which exploits the reusability of the launch vehicle used to transport payloads, such as satellites, into space. Work on reusable launch systems is motivated by economic and material reasons; a significant cost reduction is attained by reusing the first stage rocket hardware.

II. METHODOLOGY

The Method for this project is involves a simplified rocket for simulation with basic PID control scheme. Rocket design includes the vanilla rocket design as base model. This model is suited by choosing appropriate shape for low air drag. Since simulation doesn't account for Air resistance this is purely an aesthetic choice for now. Tuning a control loop is the adjustment of its control parameters (proportional band/gain, integral gain/reset, derivative gain/rate) to the optimum values for the desired control response. Stability (no unbounded oscillation) is a basic requirement, but beyond that, different systems have different behavior, different applications have different requirements, and requirements may conflict with one another.

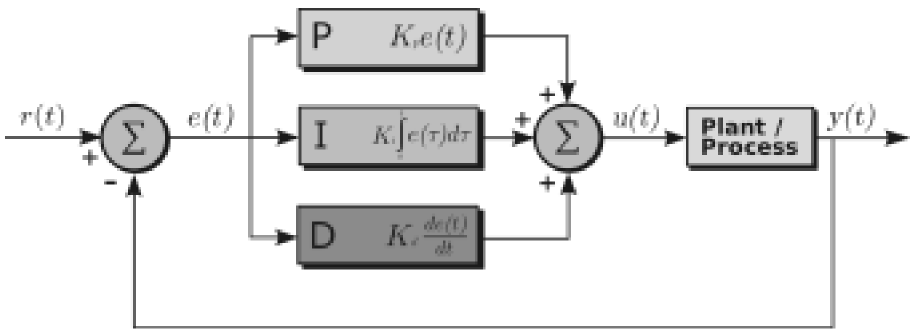

Figure 1. Block diagram Representation

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:04/Issue:06/June-2022 Impact Factor- 6.752 www.irjmets.com

III. MODELING AND ANALYSIS

Model of this project is based on the flight landing control system through air space it can land vertical direction as well as horizontal direction. And the programming is done in such a way that people can understand easily and also work in such a way that people can do.

This Open Pilot CC3D EVO Flight Controller Side Pin card has a smooth feature that allows it to work with satellite receivers directly without the use of any additional wires. It also works with S.BUS. The STM32 CPU in Evo is a strong 32-bit processor. with 128kb Flash and 20kb RAM. The 3-axis MEMs technology is used for both gyro and accelerometer.

The hardware design was underway, but owing to the Covid-19 pandemic and its impact on component shortages that impacted practically every hardware sector from phones to RFID chips, finding components has been a protracted wait that proved difficult to complete due to the obscure component selection. Import delays have delayed the project's completion deadline from weeks to months, making it difficult to leave the hardware aspect after weeks of searching. Due to the aforementioned consequences, we were forced to abandon the hardware portion of the project.

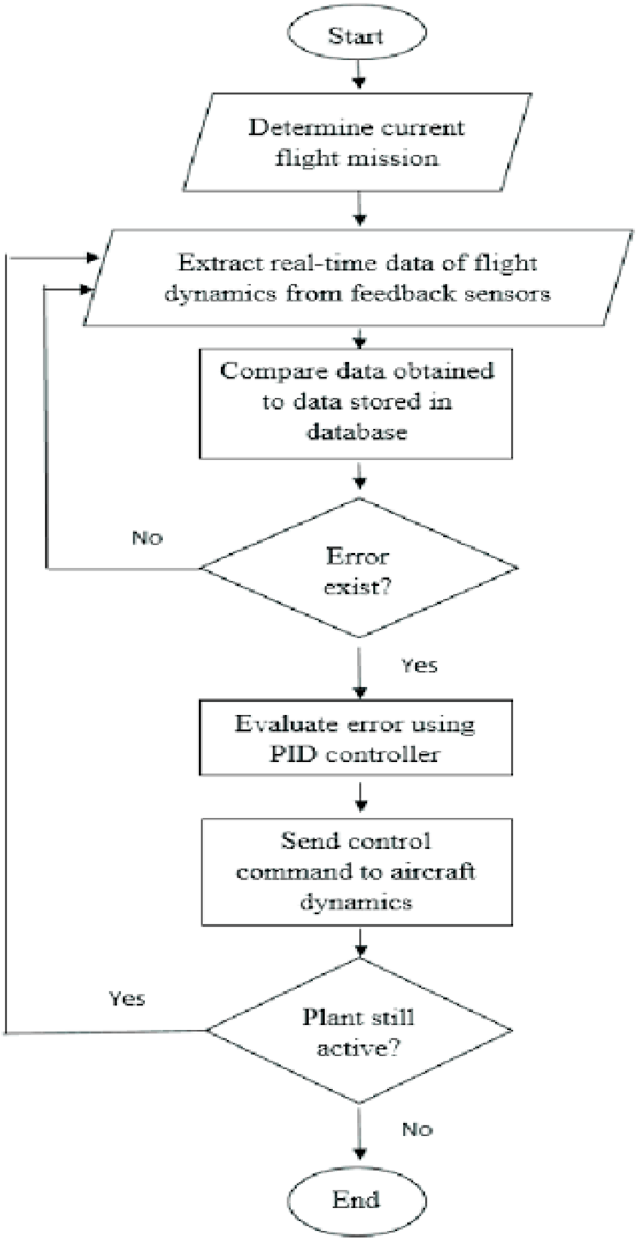

Figure 2 algorithm and flow chart

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:04/Issue:06/June-2022 Impact Factor- 6.752 www.irjmets.com

IV. RESULTS AND DISCUSSION

Project Timeline

Table 1.

Milestone	Date	completion	Remarks
Simulation setup	Dec, 21	Finished	Basic PID
Rocket Models	Dec, 21	Finished	Modelled in blender
PID Controller setup	Dec, 21	Finished	Gd script implementation
PID Tuning and calibration	Jan, 22	Finished	Manual tuning
Re-Tune PID Control	Feb, 22	Finished	C++ implementation
Hardware planning	Feb, 22	Finished	
CAD Design	Mar, 22	Finished	
3D printing	Mar, 22	Finished	
Component gathering	Mar, 22	Finished	Chip shortage

Figure 3 Main frame

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:04/Issue:06/June-2022 Impact Factor- 6.752 www.irjmets.com

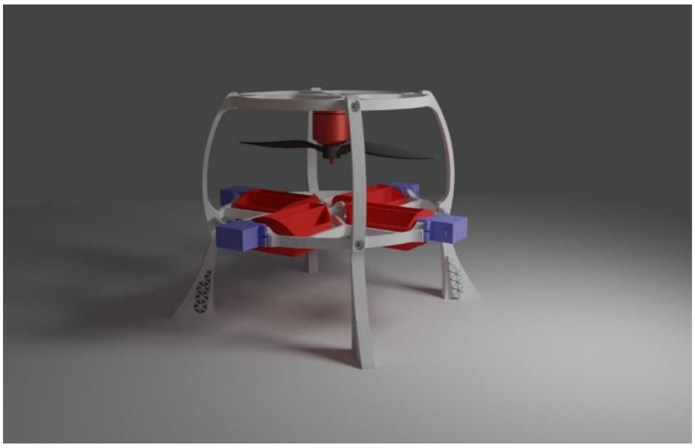

Figure 4 MK II Design Rendered

Figure 5 printer assembled

Figure 6 main frame

Figure 7 top frame

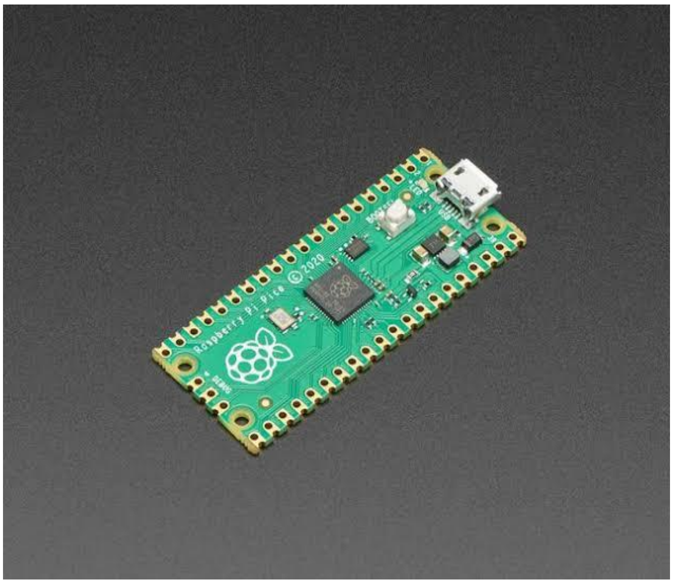

Figure 8 Raspberry pi pico

V. CONCLUSION

This project has explored the characteristics, advantages and challenges of introducing dynamic or user programmed elements in control systems. The course involves the uses of a specified aircrafts aerodynamic inertial and controllability description to conceive and design stability augmentation and autopilot control systems for that aircraft. The resulting systems are implemented in the simulator and operated in real-time by the students. As a mean of reinforcement learning.

ACKNOWLEDGEMENTS

We are grateful to our guide Prof. DR.P.SATISH KUMAR for his continuous support and guidance. Though their guidance, we were able to successfully complete our project. Sincere thanks go to DR.P.SATISH KUMAR, head of the department of Electronics and Communication Engineering at ACE Engineering College, for his support and encouragement during the project period.

VI. REFERENCES

[1] https://0x45.in/post/pid-rocket-stability/

[2] https://godotengine.org/

[3] https://en.wikibooks.org/wiki/Robotics/Navigation/Trajectory_Planning

[4] https://en.wikipedia.org/wiki/Computer_simulation

[5] https://pybullet.org/wordpress/

[6] https://pybullet.org/wordpress/index.php/2014/10/02/bullet-used-in-nasa-tensegrit y-robotics-toolkit-book-multithreading-for-visual-effects/

[7] https://ctms.engin.umich.edu/CTMS/index.php

[8] https://hackaday.io/project/175512-the-ball-drone-project-mk-ii

[9] https://www.youtube.com/c/NorthwesternRobotics