

Progress Presentation-I

e-Yantra Summer Internship-2018
Auto-tuning of controller (for Drone)

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IIT Bombay

June 21, 2018

Overview of Project

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Overview of Project

Overview of Task

Task Accomplished

Challenges Faced

Future Plans

Thank You

- **Project Name:** Auto-tuning of controller(for Drone)
- **Objective:** To propose a method of auto-tuning the PID and estimating the values of PID parameters. In this project, we will be trying to auto-tune the pluto drone.
- **Deliverables:**
 - 1 Appreciable auto-tuning of the control parameters and very stable waypoint navigation of pluto drone
 - 2 Documentation of comparing different auto-tuning techniques

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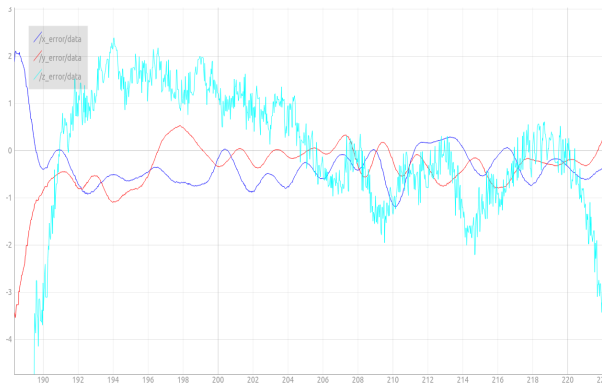
Future Plans

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Task No.	Task	Deadline (in days)
1	Literature survey of present controllers -PID, Improved PID, LQR	2
2	Implementing PID and tuning PID parameters using Ziegler-Nichols method and testing on AR-Drone model using Gazebo	2
3	Designing a better control architecture for pluto drone for position holding using whycon marker and applying Ziegler-Nichols method to tune the pluto drone manually	5
4	Literature survey of autotuning and selecting a method	2
5	Implementation of auto-tune on the improved control system and testing on AR-Drone model in Gazebo	3
6	Implementing the auto-tune on plto drone using different techniques and comparing them.	14
7	Documentation	2

Task Accomplished

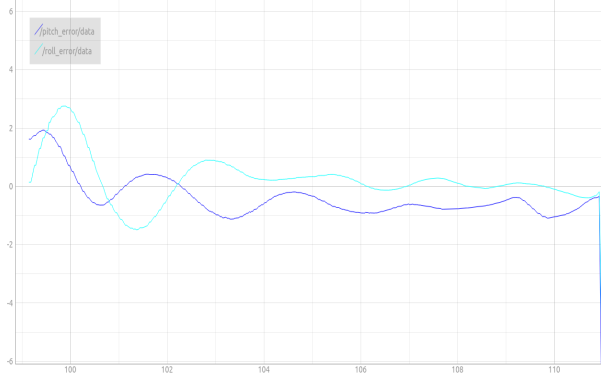
- Implemented a PD Controller for position holding of Pluto X.



- 1 Steady state error!
- 2 Need of PID controller.

Task Accomplished

- Implemented a PID controller for position holding of Pluto X.



- 1 Steady state error minimised!
- 2 Manual tuning is tedious!.

Auto-tuning Methods

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■ Method 1: Auto-tuning based on Ziegler-Nichols approach.

Cause forced oscillations to get a ultimate gain **K_u** and ultimate period **T_u**, and then determine **K_p**, **K_i**, **K_d** using Ziegler-Nichols method.

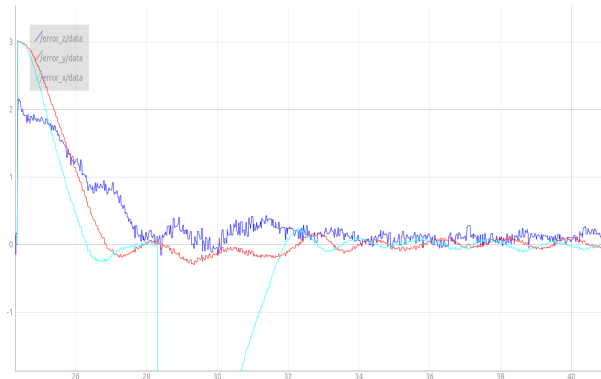
■ Method 2: Iteration Based Auto Tuning

In this method, the user enters a range for PID parameters i.e. **K_p**, **K_i** and **K_d**. The algorithm uses a set of iterations to find optimum values.

Auto-tuning based on Ziegler-Nichols approach

- Simulating position holding of AR Drone in Gazebo by auto-tuning PID parameters.

Cause forced oscillations to get a ultimate gain **K_u** and ultimate period **T_u**, and then determine **K_p**, **K_i**, **K_d** using Ziegler-Nichols method.



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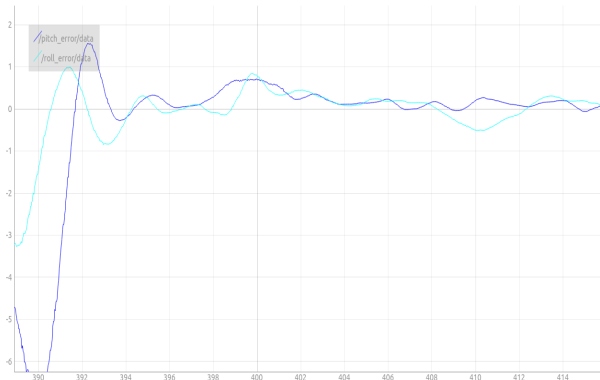
Challenges Faced

Future Plans

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Auto-tuning based on Ziegler-Nichols approach

- Implementing position holding and waypoint navigation of Pluto X drone by auto-tuning PID parameters.



Auto-tuning based on Ziegler-Nichols approach

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Advantages:

- 1 The auto-tuned PID parameters are consistent.
- 2 No need to repeat this process every time.

Disadvantages:

- 1 Need of manually monitoring the drone while tuning.

Iteration Based Auto Tuning

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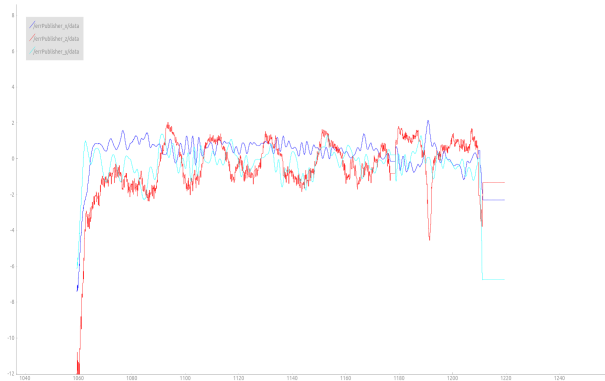
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Challenges Faced

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- Implementing position holding on Pluto X drone using self found PID parameters



Iteration Based Auto Tuning

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Future Plans

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Advantages:

- 1 No human monitoring or intervention required **even in a restricted frame.**
- 2 Auto tuning takes place on the go.

Disadvantages:

- 1 On an average it takes 115 seconds for auto tuning to complete.

Challenges Faced

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Future Plans

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- Stabilising the drone on Z axis (throttle axis) (Pending)
- Implementing the auto-tuning concept.
- Hardware breakdowns.

Future Plans

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Future Plans

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- Stabilising the drone on Z axis
- Making the PID architecture more robust.
- Increasing the efficiency and consistency of auto-tuning.
- Documentation.

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THANK YOU !!!