Progress Presentation-II

e-Yantra Summer Internship-2018

Auto-tuning of controller (for Drone)

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Overview of Project

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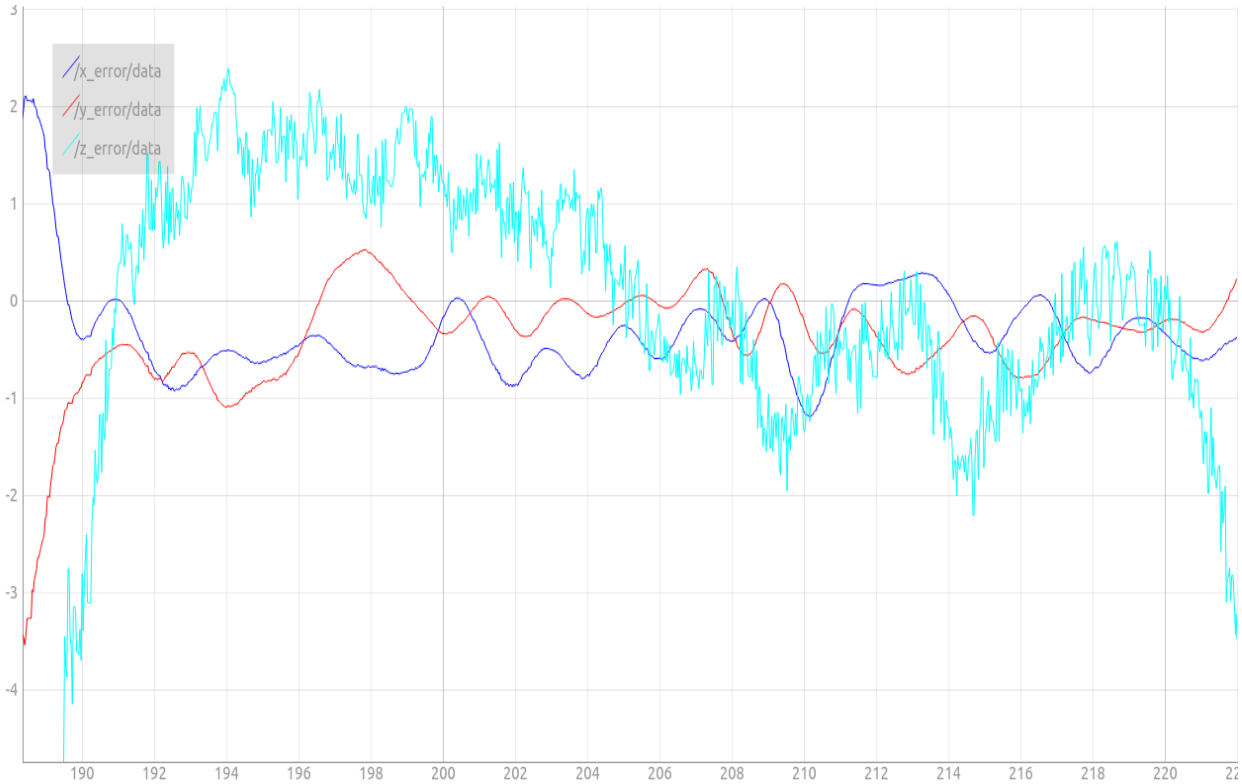
- **Project Name**: Auto-tuning of controller(for Drone)
- **Objective**: To propose a method of auto-tuning the PID and estimating the values of PID parameters. In this project, we will be trying to auto-tune the pluto drone.
- **Deliverables**:
  1. Appreciable auto-tuning of the control parameters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

Overview of Task

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

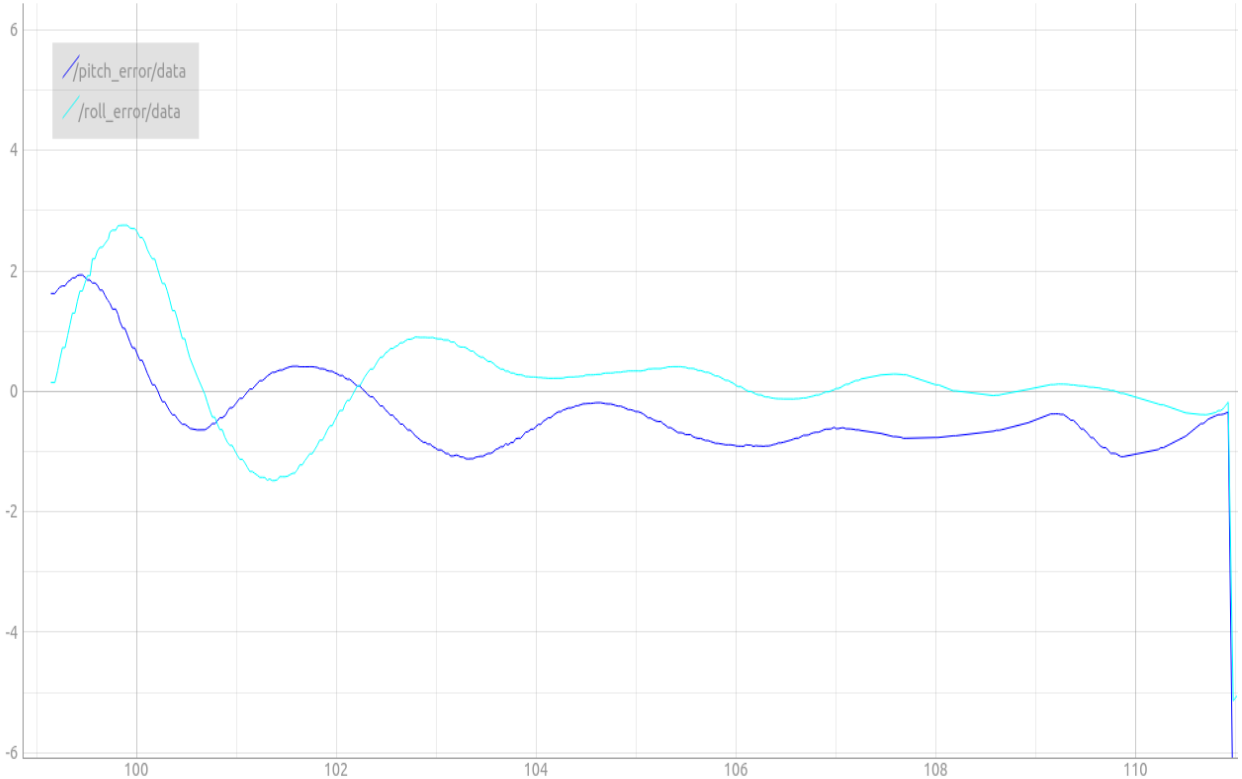
- Implemented a PD Controller for position holding of Pluto X.



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 **Ku** and ultimate period **Tu**, and then determine **Kp, Ki, Kd** using Ziegler-Nichols method.

- **Method 2: Iteration Based Auto Tuning**

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

Auto-tuning based on Ziegler-Nichols approach

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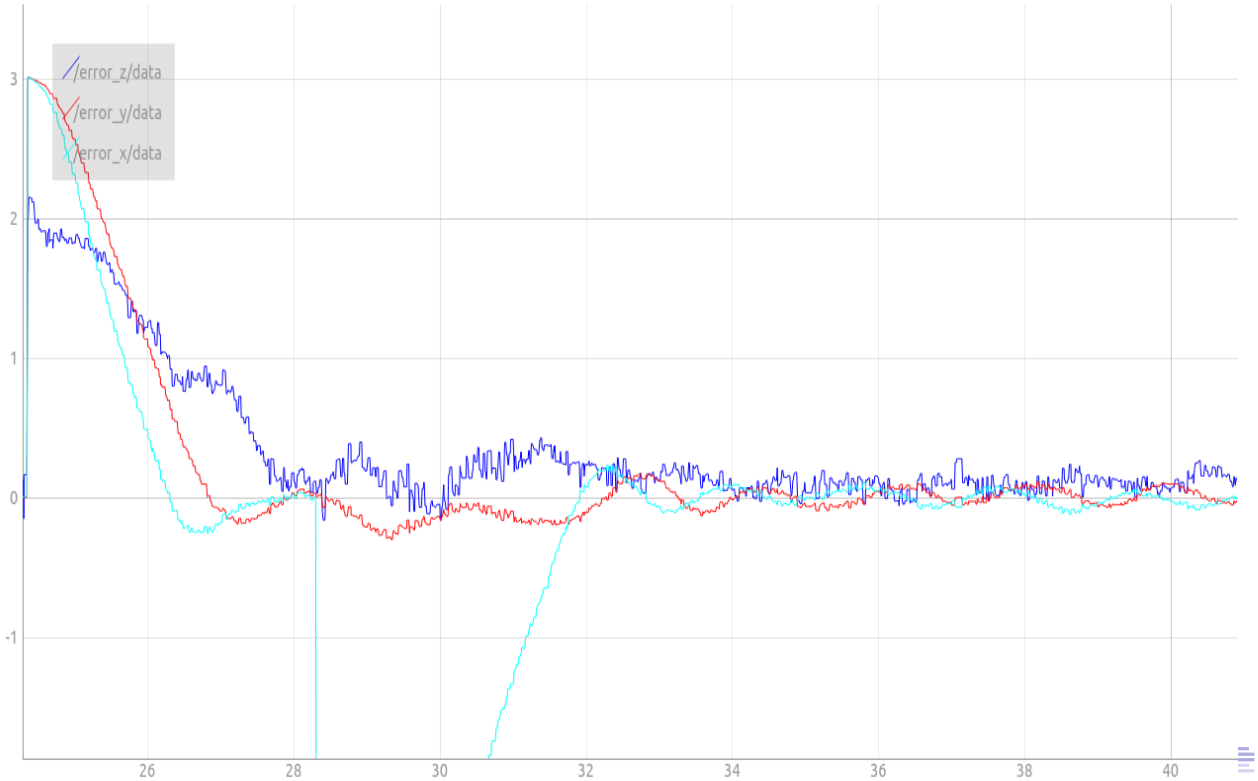
- Simulating position holding of AR Drone in Gazebo by auto-tuning PID parameters.

  Cause forced oscillations to get a ultimate gain **Ku** and ultimate period **Tu**, and then determine **Kp, Ki, Kd** using Ziegler-Nichols method.



Auto-tuning based on Ziegler-Nichols approach

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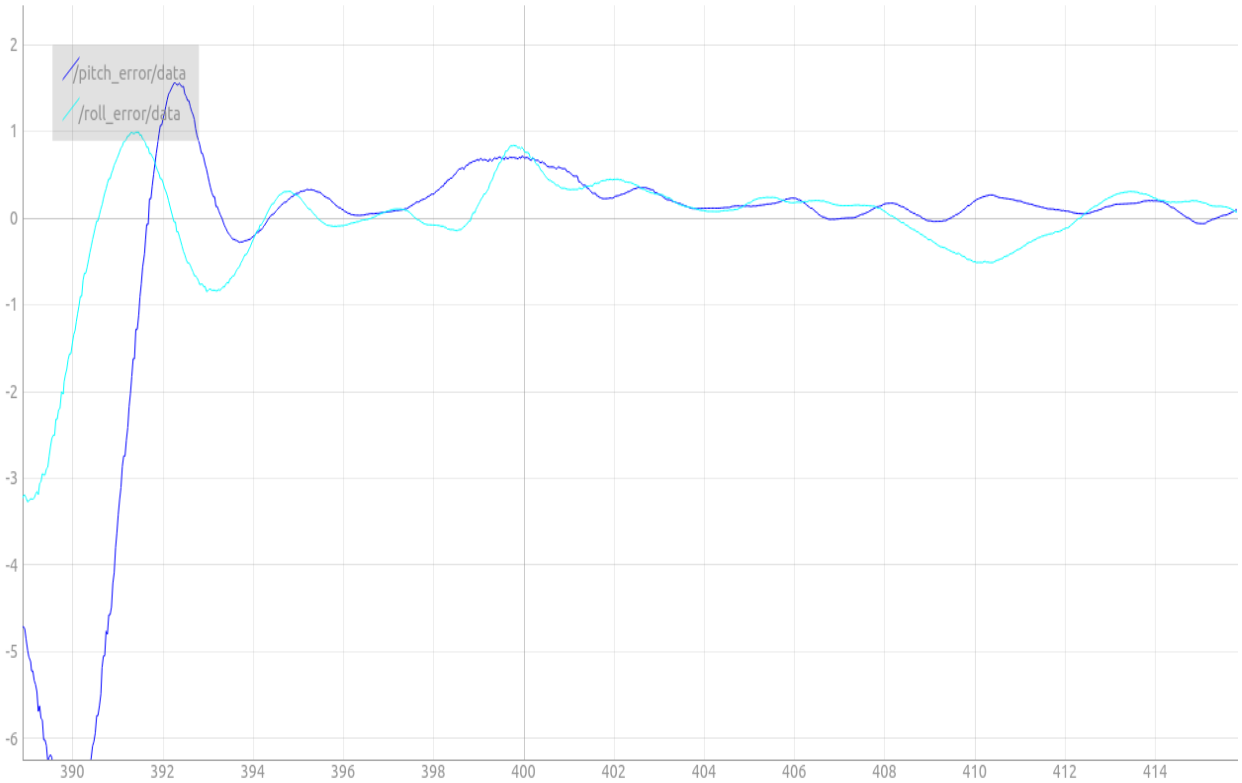
- Implementing position holding and waypoint navigation of Pluto X drone by auto-tuning PID parameters.



Auto-tuning based on Ziegler-Nichols approach

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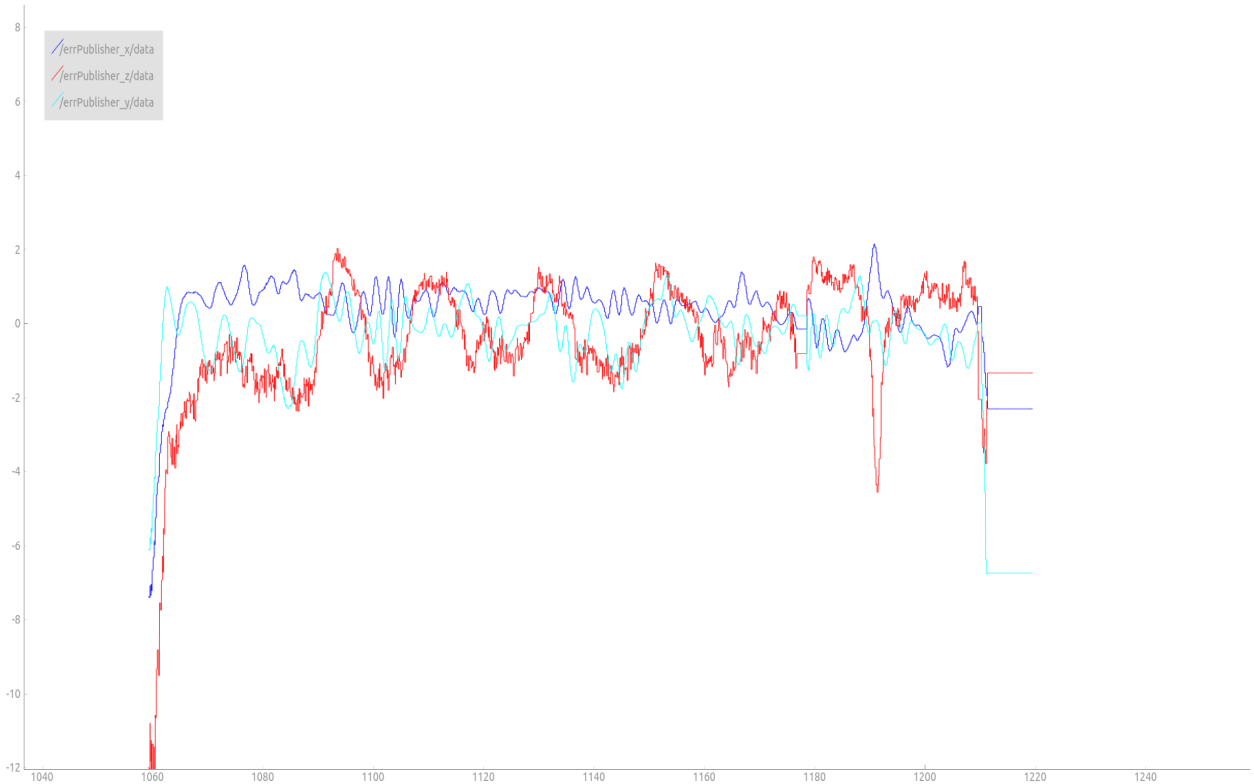
- Implementing position holding on Pluto X drone using self found PID parameters



Iteration Based Auto Tuning

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

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

Future Plans

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

Thank You

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THANK YOU !!!