Rule Book

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RULE-BOOK

PS: Control System for Drone Stabilization and Precision Motion

1. Overview

This challenge requires teams to build a complete **stabilization and precision motion control system** for the Pluto drone. The system must achieve stable hover, altitude consistency, and precise 10–20 cm micro-movements using on-board computation only.

The drone must rely solely on the following onboard sensors:

- Optical Flow
- Time-of-Flight (ToF)
- IMU
- Barometer

All computation must run within **MagisV2 firmware**.

2. General Rules

1. Teams must use only the official drone, MagisV2 firmware, and provided sensors.
2. No external computation (laptop, cloud, phone), motion tracking, or external sensors are allowed.
3. Stick inputs must map to **discrete displacement commands**, not continuous velocity control.
4. Code must be written for real-time microcontroller constraints.
5. Unsafe flight or uncontrolled behavior leads to immediate disqualification.

3. Allowed & Not Allowed

3.1 Allowed

- Custom MagisV2 firmware modifications
- Custom filtering & control designs
- PID tuning
- Debug overlays / dashboards
- Well-structured modular code

3.2 Not Allowed

- Offboard computing
- External sensors (lidar, cameras, motion capture)
- Physical modification of drone hardware
- Adding markers, weights, reflectors
- Continuous RC-like movement mapping

4. Task Requirements

4.1 Hover Stability

The drone must:

- Take off via a single trigger
- Enter stable hover mode
- Hold X-Y-Z position

- Maintain altitude up to **2 meters**
- Resist disturbances and recover quickly

4.2 Precision Micro-Movement

Each stick input must trigger a **10–20 cm** movement:

- Pitch → forward/back
- Roll → left/right
- Throttle → up/down

The system must ensure:

- Smooth acceleration & deceleration
- No overshoot (±2 cm tolerance)
- Clean stop and instant hover at new point
- Ignoring accidental micro-stick noise

5. Sensor Fusion Requirements

A robust fusion of the following is required:

- Optical Flow
- ToF
- IMU
- Barometer

Fusion must remain stable across:

- Low-texture floors
- Lighting variations
- Optical flow dropouts
- ToF noise at height
- Micro-vibrations
- Slow yaw rotation

Graceful degradation is mandatory.

6. Failure Conditions (Resulting in Disqualification)

- Continuous drifting with no correction
- Oscillatory or unsafe flight
- Overshoot during micro-movements
- Dependence on external devices
- Movement directly proportional to stick input
- Sensor spoofing or hardware changes

7. Judging & Evaluation

Teams will be evaluated based on:

- Hover stability
- Micro-movement accuracy
- Control system architecture
- Sensor fusion reliability
- Innovation
- Documentation and presentation

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Subbmission Guidelines

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SUBMISSION GUIDELINES / CRITERIA

1. Required Deliverables

Each team must submit **four main components**:

A. Firmware Implementation

A complete MagisV2-ready codebase including:

- Sensor reading + filtering (OF, ToF, IMU)
- Velocity estimation
- Position, velocity, attitude controllers
- Auto-hover logic
- Micro-movement execution
- Parameter tuning
- Fallback behavior under poor sensor input
- Modular and readable structure

Format: Complete Project ZIP file.

B. Technical Documentation (PDF)

Must include:

1. System Architecture Diagram
2. Sensor Fusion Design (OF + ToF + IMU + Baro)
3. Control Architecture (Position → Velocity → Attitude)
4. PID Tuning Strategy + Final Gains
5. Hover Stability Results
6. Micro-Movement Accuracy Results
7. Logs, graphs, plots, overlays
8. Failure Handling Strategy
9. Limitations, improvements

C. Demo Video

The video must show:

1. Takeoff
2. Stable hover
3. Drift-free stability
4. Altitude hold up to 2m
5. Disturbance recovery
6. 10–20 cm micro-movements in:

- Forward
- Backward
- Left
- Right
- Up
- Down

7. Smooth stop and instant hover at each target

D. Submission Structure

```
Submission_IITNAME/
├── Code/
├── Docs/
│   └── Technical_Report.pdf
├── Video/
│   └── demo.mp4
├── README.md
```

2. Submission Deadlines

Teams must submit all deliverables before the official deadline announced by the organizers.

3. Submission Criteria Checklist

Firmware

- Runs fully on-board
- Stable, deterministic performance
- No external compute

Documentation

- Clear explanation of approach
- Includes reasoning for design choices
- Includes plots, measurements, overlays

Video

- Demonstrates all required functionalities

Code Quality

- Modular
- Readable
- Well-commented
- Maintainable