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Department of Informatics, Faculty of Informatics

FPV UAV Firmware Review & Deployment

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Research Objective
and problem research

- Research of the technologies used in FPV firmware
- Research of the FC firmware logic
- Durable firmware for microcontroller development
- Deployment of the FC firmware

What is Flight Controller firmware

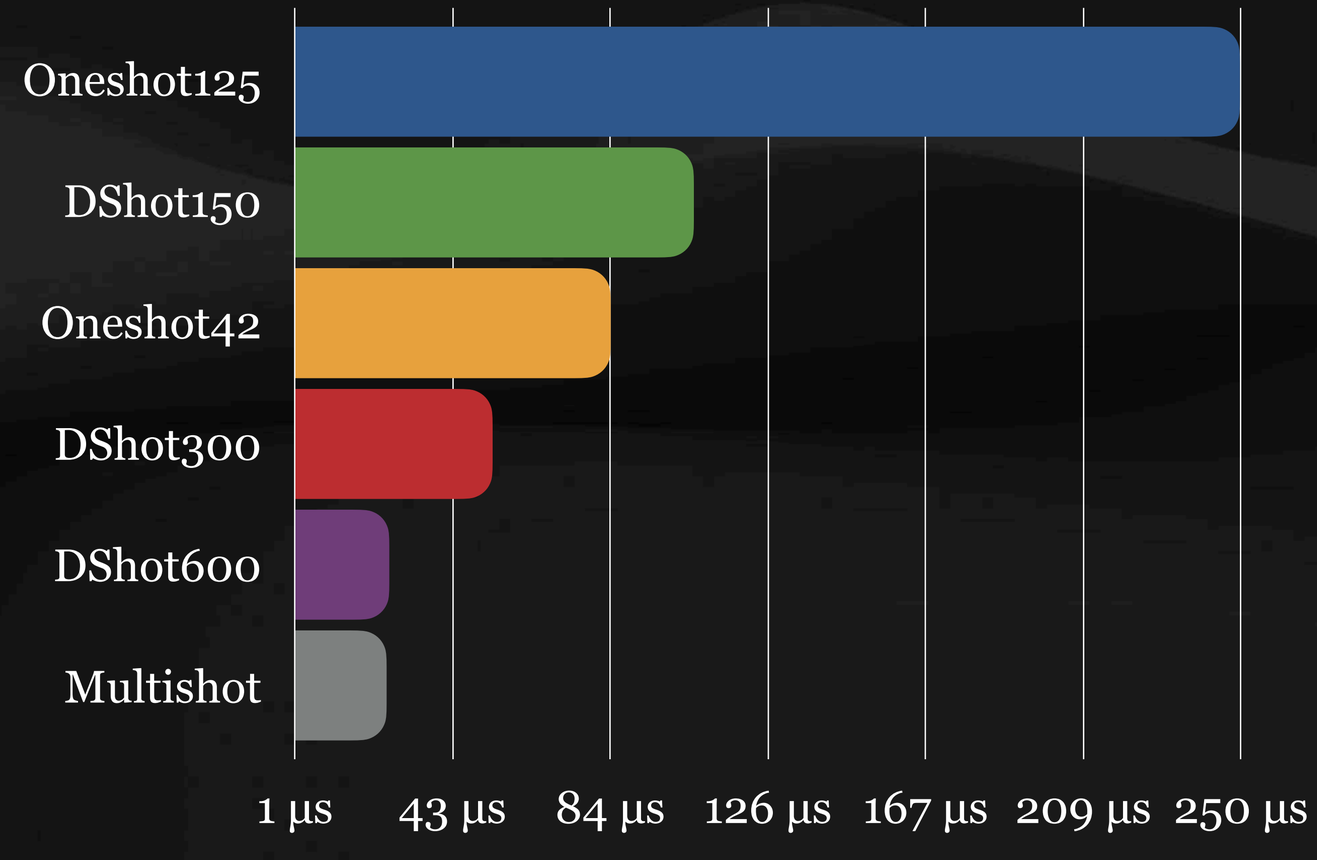
thing that affects each part of the drone

- Drone Stabilisation
- Flight Mode Control
- Sensors Reading
- Telemetry and OSD Integration
- Fail-Safe Mechanisms
- Blackbox Logs

Technologies used

DShot
Digital Shot

- Packets have a checksum to confirm the correctness and integrity of data
- Types distinguished by speed
- No need for calibration



ELRS

Rx communication

ELRS:

- Open-source Radio Link for RC applications
- Features: low latency, long range
- Designed for FPV Racing, high packet rates
- Adaptive frequency hopping for stable connection

CRSF packets

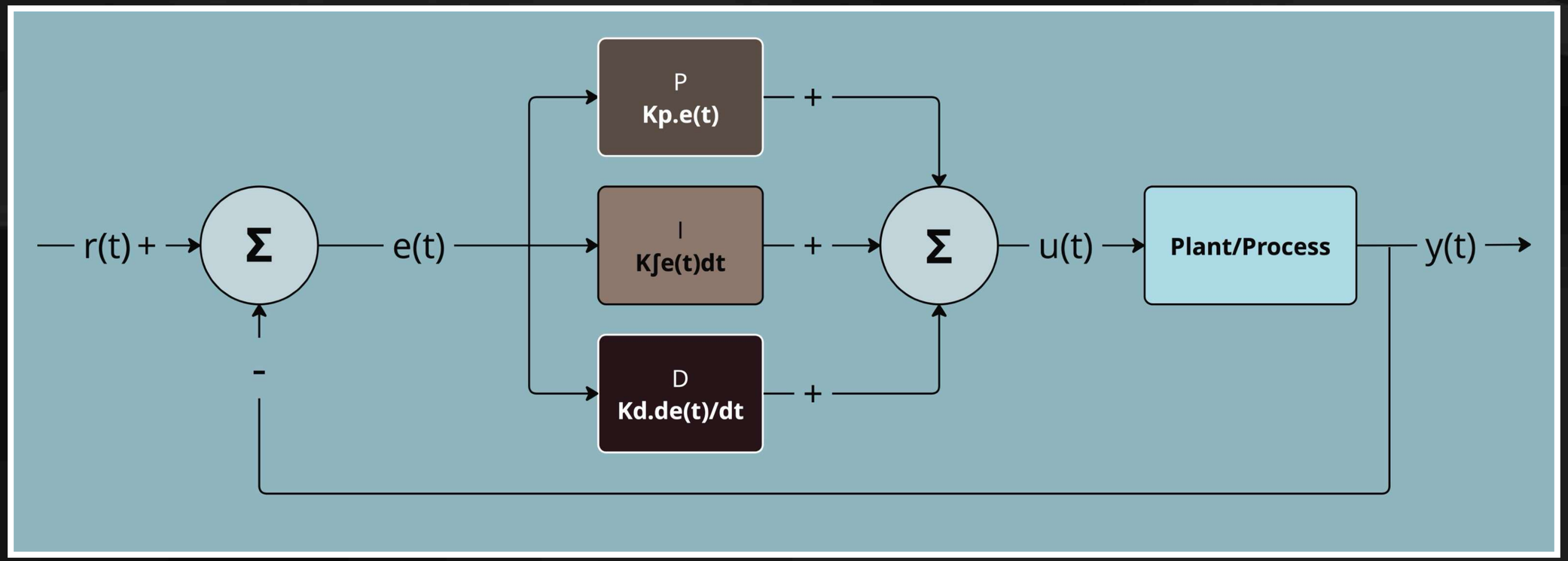
Rx communication

CRSF Packets:

- Used with ExpressLRS protocol
- Includes control commands, telemetry data
- Ensures synchronization, length indication, error detection
- Facilitates reliable communication in drone systems

PID controller

Block diagram of PID controller



PID controller

Proportional Integral Derivative

P (Proportional):

- Corrects in proportion to present error
- Larger error means bigger correction

D (Derivative):

- Predicts future error
- Smooths overshoot near target

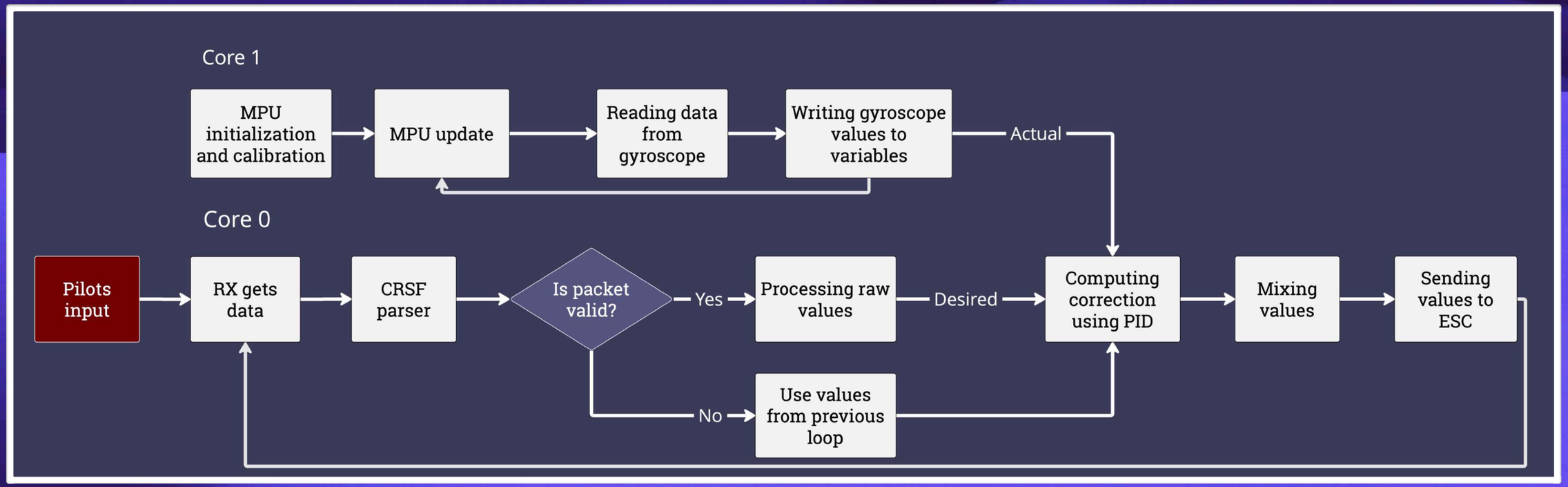
I (Integral):

- Accumulates past errors
- Counteracts external forces over time

Developed MVP

General system design

PicoFlight



Arm-Disarm testing

Fail-safe mechanism

https://youtu.be/IApuT1MYMPs

First flight

successful*

https://youtu.be/05Vvv0IuqLM

Thanks for attention

Q&A

Further work

- Flight modes: angle, altitude hold
- New sensors: barometer, magnetometer, GPS
- On screen display
- Return to home