ESP32-Based Mini Quadcopter

PROPOSAL

2025.04.22

Inha University Department of Information and Communication Engineering
Elton Satiyev: 12244853
Ikram Mammadov: 12244858

인하대학교

Research Objectives

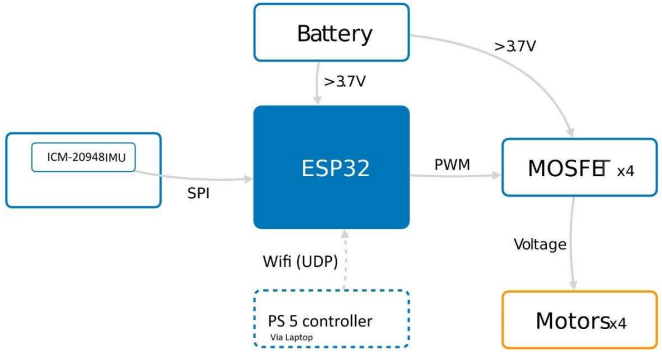
- **ESP32-Based Remotely Controlled Mini Quadcopter**
  - To develop a real-time, wireless flight control system for a quadcopter using an ESP32 microcontroller and a PS5 controller, enabling precise manual flight through Wi-Fi, with onboard stabilization.
- **Key Objectives**
  - Design a Wi-Fi-based control protocol between a ground station and an ESP32-based quadcopter.
  - Capture user input through a PS5 controller and map it to quadcopter movement commands.
  - Integrate ICM-20948 IMU to measure orientation and movement.
  - Develop and tune a real-time PID-based stabilization loop for maintaining balance in roll and pitch axes.

System Configuration

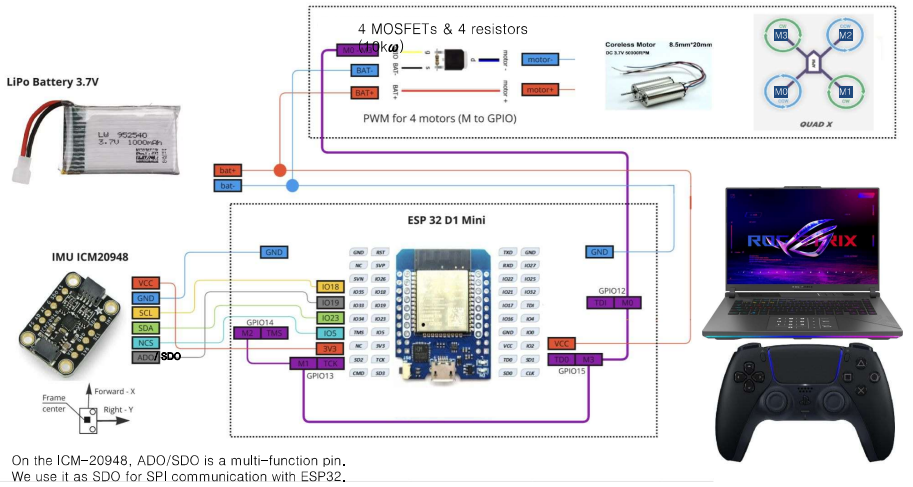
- **Block diagram & System Features**

Communication Flow:

- joystick → Laptop
- Laptop → ESP32: UDP over Wi-Fi
- ESP32 → Motors: PWM signal via MOSFETs
- IMU → ESP32: SPI interface for angle feedback



Circuit Diagram



Main Part

PID-Based Stabilization and Motor Control

Maintain stable flight by dynamically adjusting motor speeds using real-time IMU feedback and user input.

- Input:
  - IMU (ICM-20948): Provides angular velocity (gyroscope) and linear acceleration (accelerometer) for roll, pitch, and yaw.
  - User Input: Throttle, pitch, roll, and yaw commands received from the PS5 controller via laptop over Wi-Fi.
- Output:
  - PWM signals are sent to 4 MOSFETs, controlling the motor speeds individually.
  - Ensures smooth and stable quadcopter response to input and external disturbances.

Part List

Part Name	Model	Quantity	Price
Microcontroller	아두이노 ESP32 D1 mini 호환보드	1	11000원
IMU	ICM-20948	1	13200원
Motor	Coreless Motor 3.7V 50000RPM	4	8800원
MOSFET	100N03A	4	8000원
Propeller	55mm long	4	2600원
Battery	LiPo 3.7V 1000mAh	1	5000원
Charger		1	4000원
Battery connector cable	MX2.0 2P female	1	1700원

Total:
~60000

Project Plan