

DESIGN AND IMPLEMENTATION OF AN ESP32-BASED ON-BOARD-COMPUTER FOR A 1U CUBESAT EDUCATIONAL PROTOTYPE

The growing need for hands-on space technology education demands affordable, easily accessible learning kits that let students build and test core satellite subsystems. Existing CubeSat kits such as HeptaSat, KitSat, and OpenOrbiter are costly, imported, and lack local support, limiting adoption in Indonesia. This research addresses that gap by designing and partially implementing a low-cost 1U CubeSat prototype focused on its On-Board Computer (OBC) subsystem, using the ESP32 microcontroller as the central controller.

The ESP32's dual-core processor, built-in Wi-Fi/Bluetooth, and multiple I²C/UART interfaces enable real-time data acquisition and control of three flight-representative sensors (MPU6050 IMU, BMP280 pressure/temperature, NEO-6M GPS). Task scheduling is managed by FreeRTOS, sensor fusion uses Madgwick and Kalman filters, and data is logged to microSD and streamed via WebSocket to a browser dashboard. By leveraging off-the-shelf components, open-source firmware, and a modular architecture, this prototype offers a replicable, locally adaptable platform that immerses students in embedded satellite systems without prohibitive costs.

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