

PROYEK: RANCANG BANGUN SISTEM *MONITORING* DAN KENDALI IRIGASI TETES PRESISI DI LINGKUNGAN FIK UPNVJ BERBASIS *MOBILE*

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ABSTRAK

Pengelolaan irigasi konvensional secara manual sering kali tidak efisien karena ketiadaan antarmuka digital berbasis *mobile* untuk pemantauan dan kendali jarak jauh. Proyek ini bertujuan merancang dan membangun aplikasi *mobile* berbasis Flutter sebagai antarmuka utama sistem *monitoring* dan kendali irigasi tetes presisi untuk tanaman caisim di *greenhouse* FIK UPNVJ. Pengembangan menggunakan metode *System Development Life Cycle (SDLC) V-Shape Model*. Aplikasi dikembangkan dengan arsitektur *Model-View-ViewModel (MVVM)* dan *Provider State Management*, yang mengonsumsi data dari arsitektur IoT *edge-cloud* berbasis Raspberry Pi dengan algoritma *Fuzzy Logic Mamdani* dan mikrokontroler ESP32. Fitur utama mencakup *dual-role dashboard* (Operator dengan autentikasi JWT dan Publik *read-only*), pemantauan data sensor secara *real-time*, kendali manual aktuator (pompa, katup solenoid, dan motor *slider*) berbasis *three-phase feedback*, serta *streaming* data via WebSocket dengan pemulihan koneksi otomatis. Hasil pengujian menunjukkan aplikasi mampu menampilkan telemetri secara *real-time*, merespons perintah kendali dalam waktu ≤ 2 detik, dan mencapai tingkat keberhasilan pengujian *User Acceptance Test (UAT)* sebesar 100%. Dengan demikian, aplikasi *mobile* ini sangat layak dan efektif diimplementasikan sebagai antarmuka kendali irigasi tetes presisi cerdas.

Kata Kunci : *Internet of Things*, Irigasi Tetes Presisi, *Fuzzy Logic*, *Edge Computing*, Aplikasi *Mobile*

**PROJECT: DESIGN AND DEVELOPMENT OF A MOBILE-BASED
PRECISION DRIP IRRIGATION MONITORING AND CONTROL SYSTEM
AT THE FIK UPNVJ**

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ABSTRACT

Manual conventional irrigation management is often inefficient due to the lack of a mobile-based digital interface for remote monitoring and control. This project aims to design and build a Flutter-based mobile application as the primary interface for a precision drip irrigation monitoring and control system for mustard greens (caisim) in the FIK UPNVJ greenhouse. Development follows the System Development Life Cycle (SDLC) V-Shape Model. The application is developed using the Model-View-ViewModel (MVVM) architecture with Provider State Management, consuming data from an edge-cloud IoT architecture comprising a Raspberry Pi running the Mamdani Fuzzy Logic algorithm and ESP32 microcontrollers. Key features include a dual-role dashboard (JWT-authenticated Operator and read-only Public), real-time sensor data monitoring, manual actuator controls (water pump, solenoid valves, and slider motor) with three-phase feedback, and WebSocket data streaming with automatic reconnection. Test results demonstrate that the application displays real-time telemetry, responds to control commands within ≤ 2 seconds, and achieves a 100% User Acceptance Test (UAT) success rate. Consequently, this mobile application is highly feasible and effective as a smart interface for precision drip irrigation.

Keywords: *Internet of Things, Precision Drip Irrigation, Fuzzy Logic, Edge Computing, Mobile Application*