Development of an IoT-Based Apple Ozonation System Using Fuzzy Mamdani Integrated with Android

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ABSTRACT

This IoT-based automated apple sterilization system is designed to replace manual chemical washing methods that risk leaving hazardous residues, utilizing an ESP32 microcontroller as the central control unit that integrates DS18B20 temperature, pH, and TDS sensors to monitor water conditions in real-time. The data acquired from these multi-sensors is then processed using Fuzzy Mamdani logic to accurately determine the ozone generator runtime via a relay module, where experimental results demonstrate outstanding system performance, achieving a fuzzy control accuracy rate of 98.78% with a minimal margin of error. Furthermore, the Flutter-based Android application connected to a Firebase database successfully passed black-box functional testing with a 100% success rate in executing all critical remote operations smoothly, ranging from real-time parameter visualization and historic data tracking to instantaneous emergency shutdown triggers.

Keywords: Android integration, apple sterilization, ESP32, Fuzzy Mamdani, Internet of Things.