

ABSTRAK

SISTEM *MONITORING* KUALITAS UDARA DAPUR UMKM BERBASIS IoT MENGGUNAKAN KONTROL *ON-OFF* HISTERESIS DAN ANALISIS *RANDOM FOREST*

(2026: xv + 99 Halaman + 35 Gambar + 30 Tabel + Daftar Pustaka + Lampiran)

AHMAD SAYYIDUL ANUGGRAH

062240342199

JURUSAN TEKNIK ELEKTRO

PROGRAM STUDI SARJANA TERAPAN TEKNIK ELEKTRO

POLITEKNIK NEGERI SRIWIJAYA

Aktivitas memasak pada dapur UMKM menghasilkan gas LPG, gas hasil pembakaran, serta peningkatan suhu yang dapat menurunkan kualitas udara. Penelitian ini bertujuan merancang sistem monitoring kualitas udara berbasis *Internet of Things* (IoT) menggunakan ESP32, sensor MQ-6, MQ-135, dan DHT22 dengan metode kontrol *ON-OFF* histeresis, serta menganalisis data hasil pengujian menggunakan algoritma *Random Forest*. Sistem mampu memantau kualitas udara secara *real-time*, mengendalikan *exhaust fan* secara otomatis, menampilkan informasi pada LCD, serta mengirimkan notifikasi melalui Telegram Bot dan ESP32-CAM. Data hasil pengujian sebanyak 775 data dianalisis menggunakan *Random Forest* melalui tahapan *preprocessing*, pembagian data *training* dan *testing* (80:20), pelatihan model, serta evaluasi menggunakan *confusion matrix*, *accuracy*, *precision*, *recall*, *F1-score*, dan *feature importance*. Hasil penelitian menunjukkan bahwa kontrol *ON-OFF* histeresis mampu menjaga kestabilan kerja *exhaust fan* dan mengurangi fenomena *chattering*. Model *Random Forest* menghasilkan akurasi sebesar 98,71% dengan nilai *precision*, *recall*, dan *F1-score* yang tinggi dalam mengklasifikasikan kondisi Normal, Waspada, dan Bahaya. Analisis *feature importance* menunjukkan bahwa parameter suhu memiliki kontribusi terbesar (53,68%), diikuti MQ-135 (29,73%), MQ-6 (13,04%), dan kelembapan (3,55%). Dengan demikian, sistem yang dikembangkan mampu melakukan monitoring kualitas udara dapur UMKM secara efektif dan mendukung evaluasi kondisi udara berbasis data.

Kata kunci: *Internet of Things*, kualitas udara dapur, kontrol *ON-OFF* histeresis, *Random Forest*, ESP32.

ABSTRACT

IoT-BASED AIR QUALITY MONITORING SYSTEM FOR MSME KITCHENS USING ON-OFF HYSTERESIS CONTROL AND RANDOM FOREST ANALYSIS

(2026: xv + 99 Pages + 35 Figures + 30 Tables + References + Appendices)

AHMAD SAYYIDUL ANUGGRAH

062240342199

BACHELOR OF APPLIED ELECTRICAL ENGINEERING

ELECTRICAL ENGINEERING DEPARTMENT

STATE POLYTECHNIC OF SRIWIJAYA

Cooking activities in Micro, Small, and Medium Enterprises (MSME) kitchens generate LPG gas, combustion gases, and increased temperature, which may reduce indoor air quality and pose safety risks. This study aims to develop an Internet of Things (IoT)-based kitchen air quality monitoring system using an ESP32 microcontroller integrated with MQ-6, MQ-135, and DHT22 sensors, employing the ON-OFF hysteresis control method and Random Forest algorithm for data analysis. The proposed system performs real-time air quality monitoring, automatically controls exhaust fans, displays information on an LCD, and sends notifications through Telegram Bot and ESP32-CAM. A total of 775 sensor records were analyzed using the Random Forest algorithm through data preprocessing, an 80:20 training-testing split, model training, and performance evaluation using a confusion matrix, accuracy, precision, recall, F1-score, and feature importance. The results demonstrate that the ON-OFF hysteresis control effectively maintains exhaust fan stability and minimizes the chattering phenomenon. The Random Forest model achieved an accuracy of 98.71%, with high precision, recall, and F1-score in classifying air quality into Normal, Warning, and Danger conditions. Feature importance analysis revealed that temperature was the most influential parameter (53.68%), followed by MQ-135 (29.73%), MQ-6 (13.04%), and humidity (3.55%). Therefore, the proposed system provides an effective solution for real-time air quality monitoring in MSME kitchens while supporting data-driven evaluation of indoor air quality.

Keywords: *Internet of Things, kitchen air quality, ON-OFF hysteresis control, Random Forest, ESP32.*