

ABSTRAK

SISTEM DETEKSI KUALITAS MINYAK GORENG BERBASIS MULTIMODAL SENSOR MENGGUNAKAN ALGORITMA KECERDASAN BUATAN

(2026: 75 Halaman + 27 Gambar + 15 Tabel + Daftar Pustaka + Lampiran)

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Kualitas minyak goreng memengaruhi keamanan pangan dan kesehatan masyarakat. Penggunaan minyak goreng secara berulang menyebabkan perubahan warna, suhu, dan terbentuknya senyawa volatil yang menandakan penurunan kualitas minyak. Penilaian secara visual masih bersifat subjektif sehingga diperlukan sistem deteksi yang lebih objektif. Penelitian ini bertujuan merancang sistem deteksi kualitas minyak goreng berbasis multimodal sensor menggunakan algoritma Random Forest. Sistem menggunakan mikrokontroler ESP32-S3 yang terintegrasi dengan sensor warna TCS34725, sensor gas MQ135, dan sensor suhu DS18B20. Data sebanyak 300 sampel diklasifikasikan ke dalam tiga kategori, yaitu layak, kurang layak, dan tidak layak, kemudian diproses menggunakan Random Forest pada RapidMiner dengan pembagian data training dan testing 80:20. Hasil pengujian menunjukkan akurasi klasifikasi sebesar 100%. Sistem juga mampu menampilkan hasil klasifikasi pada LCD 20×4 disertai indikator LED. Secara keseluruhan, sistem mampu mendeteksi kualitas minyak goreng secara otomatis, cepat, dan objektif.

Kata Kunci: Kualitas Minyak Goreng, Multimodal Sensor, Random Forest, ESP32-S3, RapidMiner.

ABSTRACT

COOKING OIL QUALITY DETECTION SYSTEM BASED ON MULTIMODAL SENSORS USING ARTIFICIAL INTELLIGENCE ALGORITHMS

(2026: 75 Pages + 27 Figures + 15 Tables + References + Appendices)

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Cooking oil quality affects food safety and public health. Repeated use of cooking oil causes changes in color, temperature, and volatile compounds, indicating quality degradation. Conventional visual assessment is subjective; therefore, a more objective detection system is required. This study aims to design a cooking oil quality detection system based on multimodal sensors using the Random Forest algorithm. The system employs an ESP32-S3 microcontroller integrated with a TCS34725 color sensor, an MQ135 gas sensor, and a DS18B20 temperature sensor. A dataset of 300 samples was classified into three categories: suitable, less suitable, and unsuitable cooking oil. The data were processed using the Random Forest algorithm in RapidMiner with an 80:20 training-to-testing data split. The experimental results showed a 100% classification accuracy. The system also displays the classification results on a 20×4 LCD with LED indicators. Overall, the proposed system is capable of detecting cooking oil quality automatically, quickly, and objectively.

Keywords: *Cooking Oil Quality, Multimodal Sensors, Random Forest, ESP32-S3, RapidMiner.*