ABSTRAK

RANCANG BANGUN SISTEM DETEKSI KEMATANGGAN BUAH JERUK BERBASIS PENGOLAHAN CITRA DIGITAL MENGGUNAKAN *HUE*, *SATURATION*, *VALUE COLOR SPACE* DAN OPENCV
(2026: xiii +95 Halaman + 19 Gambar + 6 Tabel + 20 Daftar Pustaka)

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Proses penentuan kematangan buah jeruk secara manual masih mengandalkan pengamatan visual terhadap warna kulit buah sehingga penilaian dapat bersifat subjektif dan kurang konsisten. Penelitian ini bertujuan merancang dan mengimplementasikan sistem deteksi kematangan buah jeruk berbasis pengolahan citra digital menggunakan HSV (Hue, Saturation, Value) Color Space dan OpenCV. Sistem dirancang dengan webcam Logitech sebagai perangkat pengambilan citra, Python dan OpenCV sebagai pengolah citra, serta Arduino Mega 2560 sebagai pengendali proses pemilahan. Citra buah yang diperoleh dikonversi dari ruang warna RGB ke HSV, kemudian dilakukan segmentasi dan analisis nilai Hue, Saturation, dan Value untuk menentukan kategori buah matang dan belum matang berdasarkan karakteristik warna kulit. Hasil klasifikasi dikirim melalui komunikasi serial ke Arduino Mega untuk mengendalikan motor servo 20 kg. Servo bergerak ke arah yang telah ditentukan sesuai kategori buah, sedangkan LCD 16×2 digunakan untuk menampilkan informasi hasil deteksi. Pengujian dilakukan terhadap 20 sampel buah jeruk yang terdiri dari buah matang dan belum matang. Hasil pengujian menunjukkan seluruh sampel berhasil diklasifikasikan sesuai kondisi sebenarnya dengan tingkat keberhasilan sebesar 100%. Sistem memiliki waktu respons rata-rata 3,81 detik, yang terdiri dari waktu deteksi 3,00 detik dan waktu servo 0,81 detik. Hasil tersebut menunjukkan sistem mampu melakukan deteksi dan pemilahan secara otomatis, konsisten, dan terintegrasi.

Kata kunci : Pengolahan Citra Digital, HSV Color Space, OpenCV, Arduino Mega 2560, Deteksi Kematangan Buah Jeruk.

ABSTRACT

DESIGN AND DEVELOPMENT OF AN ORANGE FRUIT RIPENESS DETECTION SYSTEM BASED ON DIGITAL IMAGE PROCESSING USING THE HUE, SATURATION, VALUE COLOR SPACE AND OPENCV
(2026: xiii +95 Pages + 19 Figures + 6 Tables + Attachment)

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The process of determining the ripeness of oranges manually still relies on visual observation of the fruit skin color, which may cause subjective and inconsistent assessments. This study aims to design and implement an orange fruit ripeness detection system based on digital image processing using HSV (Hue, Saturation, Value) Color Space and OpenCV. The system is designed using a Logitech webcam as an image acquisition device, Python and OpenCV as image processing tools, and an Arduino Mega 2560 as the controller for the sorting process. The obtained fruit images are converted from RGB color space to HSV, followed by segmentation and analysis of Hue, Saturation, and Value values to determine the categories of ripe and unripe fruit based on the color characteristics of the fruit skin. The classification results are transmitted through serial communication to the Arduino Mega to control a 20 kg servo motor. The servo moves in the predetermined direction according to the fruit category, while a 16×2 LCD displays the detection results. Testing was conducted on 20 orange samples consisting of ripe and unripe fruits. The test results showed that all samples were successfully classified according to their actual conditions, achieving a success rate of 100%. The system has an average response time of 3.81 seconds, consisting of a detection time of 3.00 seconds and a servo response time of 0.81 seconds. These results indicate that the system is capable of performing the detection and sorting process automatically, consistently, and in an integrated manner.

Keywords: *Digital Image Processing, HSV Color Space, OpenCV, Arduino Mega 2560, Orange Fruit Ripeness Detection.*