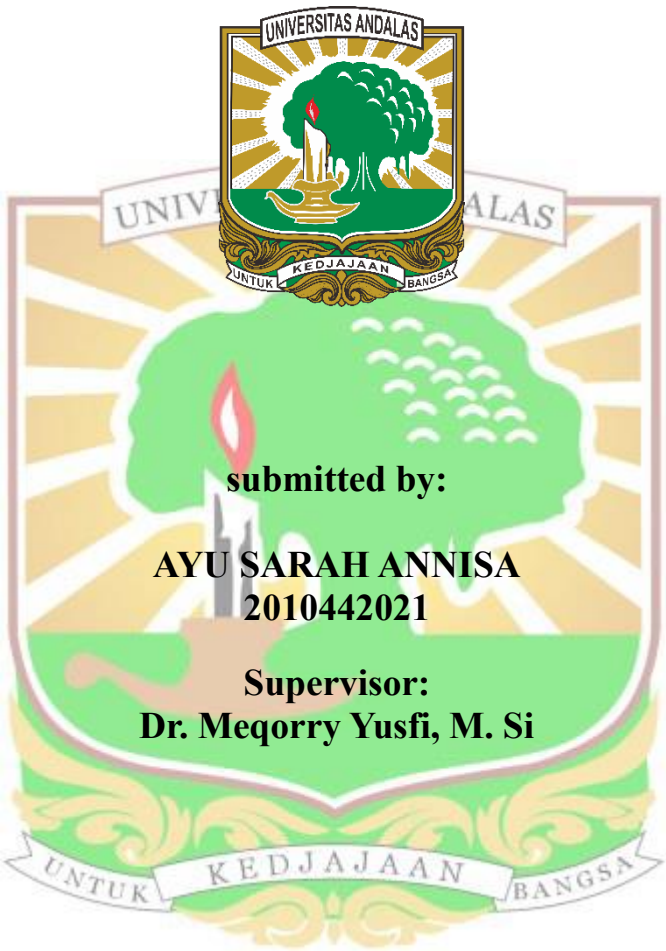
CLASSIFICATION OF BOX SIZES IN AUTOMATED SYSTEMS USING YOLO AND COMPUTER VISION

SKRIPSI



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ABSTRACT

The logistics and distribution industry requires a fast and accurate sorting system to improve operational efficiency. This research develops an automatic sorting system using computer vision and YOLO to detect and classify box sizes in real-time. The system consists of ESP32-CAM as a visual sensor, NodeMCU ESP8266 as a microcontroller, and a servo motor as an actuator, with MQTT as the communication protocol. YOLO detection results from the ESP32-CAM are sent to the NodeMCU ESP8266 through a local MQTT broker, ensuring low-latency processing without internet reliance. The YOLO-based detection model achieved an accuracy of 98.15% in detecting and classifying box sizes. System performance was evaluated using confidence levels from the top and front cameras. The top camera showed more consistent confidence levels (89–96%), while the front camera had greater fluctuations (83–96%) due to changes in object distance and angle. The system relies on the highest confidence level between the two cameras for classification, which may result in misclassification. Additionally, the system has several limitations: it was tested under fixed lighting conditions, and classification only distinguishes small ($< 5 \times 5 \times 5$ cm) and large ($\geq 5 \times 5 \times 5$ cm) boxes, making objects near the threshold prone to errors. The conveyor supports loads up to 700 grams; beyond that, performance declines, with overload at 1 kg. The system also relies on a local MQTT connection and was trained on a limited dataset, restricting its ability to classify objects beyond the given categories.

Keywords: YOLO, MQTT, automatic sorting, computer vision, ESP32-CAM, servo motor.