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Mask, Hairnet and Handwash Monitoring System using Deep Learning and IoT Technology

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Abstract: Non-compliance with hygiene protocols—such as wearing a mask or hairnet, and performing proper handwashing—in food manufacturing facilities contributes to food contamination, thereby compromising product quality, consumer trust, and brand integrity. Manual inspection methods used to monitor compliance are susceptible to human error and lack objectivity. Thus, the need for an automated solution is prominent. In response, this study developed a cabin-based system integrated with two YOLOv8-trained models: one for detecting mask and hairnet usage, and another for recognizing handwashing gestures. These models were deployed on a mini-computer (Dell OptiPlex 3080). The compliance system follows the protocol outlined as follows: (i) personnel identification via RFID scanning of the employee card, (ii) detection of mask and hairnet usage through camera input, (iii) sequential detection of handwashing gestures, (iv) regulation of door access to food manufacturing areas based on the evaluation outcome, and (v) recording of compliance results for supervisory review. The system achieved a mean Average Precision (mAP) of 99.2% for mask and hairnet compliance, and 92.7% for handwashing compliance. These experimental results support the system' s potential for deployment in food manufacturing settings to facilitate compliance monitoring and reinforce food safety assurance.

Key Words: computer vision, food manufacturing, hygiene compliance, object detection

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