**ABSTRACT**

Orange (*Citrus sinensis*) is a widely grown and universally consumed fruit. It is processed either manually or automated, with the automation process requiring appropriate sorting for grading either by quality or by size. A common descriptor in quality grading is the Colour of the epicarp/rind. This project reports the development of an innovative deep-learning system designed to enhance efficiency in Orange fruit inspection and sorting, addressing the growing demand for improved fruit inspection and sorting in agriculture. The sorting and inspection system was developed by integrating YOLO v8object detection algorithm, ESP32-CAM image capture module, and an Streamlit user interface (UI). The YOLOv8 enables the Orange recognition and detection, while the ESP32 CAM facilitates and ensures seamless image capture, transmission and real-time image feedback. Streamlit allowed interactive configuration and result visualization. The methodology entails training the YOLO v8 model on 742 annotated Images of healthy and rotten Oranges for 100 epochs with a fine-tuning process adapting the model to diverse environmental conditions. The results showed mean average precision of 0.991, F1 score of 0.883, and an average precision and recall of 0.995., These results underscore the system's effectiveness in orange inspection. The discussion provides insights into result interpretation, emphasizing successes, and acknowledging limitations encountered during implementation. Practical implications for the agriculture industry highlight the positive impact on sorting processes. Comparative analysis with traditional sorting methods and other computer vision algorithms highlights the potential to revolutionize efficiency and accuracy in fruit sorting within the agriculture sector. Overall, the presented deep learning-based system offers a promising solution for advancing the enhancement of orange inspection and sorting automation and it also signals potential strides in automation and efficiency within the agriculture sector.