**SESHADRI RAO GUDLAVALLERU ENGINEERING COLLEGE**

**(An Autonomous Institute with Permanent Affiliation to JNTUK,Kakinada)**

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**INFORMATION TECHNOLOGY**

**Smart Robotic Arm for Automated Ripened Tomato Detection and Picking**

**ABSTRACT**

Automated harvesting is a significant advancement in precision agriculture, addressing labor-intensive processes such as tomato classification and picking. This study introduces an AI-driven robotic system that combines Machine Learning (ML), Deep Learning (DL), and robotics to improve the efficiency of tomato harvesting.The dataset from RoboFlow includes 1,181 images classified as ripe or unripe. Random Forest (RF) is used for feature-based classification, while a Convolutional Neural Network (CNN) achieves 92% accuracy for deep learning-based classification.To improve classification performance, image preprocessing techniques such as color-based filtering, thresholding, resizing, normalization, and flipping are applied. The system employs an AI Hat for real- time image acquisition without an inbuilt camera module. A 5-DOF robotic arm with silicon grippers executes the picking and sorting tasks based on classification outputs. Experimental results demonstrate 92% successful tomato picking, validating the system's efficiency. Furthermore, OpenCV-based live image streaming supports real-time monitoring. A comparative analysis between ML and DL models confirms that deep learning approaches provide higher accuracy and reliability than traditional methods.Future work includes integrating infrared sensors for enhanced ripeness detection, IoT-based remote monitoring, and multi-crop adaptability. The proposed system contributes to precision agriculture by automating tomato classification and harvesting, optimizing efficiency, and minimizing human intervention through AI-driven robotics.

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