

UTILIZING ZYNQ 7000 SOC FOR AUTOMATED PLANT DISEASE DETECTION

ABSTRACT

Plant diseases are a serious threat to agricultural productivity since they can have an impact on crop quality and quantity. Worldwide, millions of tons of crops are lost each year due to various plant diseases, leading to economic losses and food security concerns. Traditional methods for managing plant diseases include chemical treatments, crop rotation, and the use of disease-resistant crop varieties. However, these measures have limitations, such as environmental impact, the emergence of resistant pathogens, and the time required for developing resistant varieties. To mitigate these losses, a real-time, computer vision-based system for detecting plant illnesses is proposed. This system aims to accurately identify two forms of diseases in plant leaves under various illumination conditions, leveraging the Xilinx ZYNQ SoC FPGA for implementation. The FPGA's low latency performance and parallel processing capabilities make it ideal for real-time applications, enabling rapid processing of high-resolution images and accurate disease detection, thus ensuring timely intervention and minimizing crop loss. The computational complexity and time demand of computer vision applications are addressed by the FPGA's powerful parallel processing and low latency performance. To further enhance the project, edge AI technology will be integrated, allowing the system to process and analyse data directly on devices at the network's edge. This reduces the need for constant connectivity to centralized servers, speeds up reaction times, and increases system resilience and dependability in various field conditions. The FPGA-based real-time plant disease detection system, enhanced by edge AI, offers an accurate and efficient solution to protect agricultural productivity and paves the way for advancements in smart agriculture.

Keywords: *Plant diseases, Xilinx ZYNQ SoC FPGA, Crop loss minimization, Edge AI technology, Smart agriculture.*

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