IMPLEMENTATION OF IOT WITH IMAGE PROCESSING IN PLANT MONITORING SYSTEM

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DECLARATION

To the best of my knowledge and belief, this thesis does not contain any previously published or written material by another person, with the exception of places where the acknowledgement is made in the text. I hereby declare that this is my own work and that no material previously submitted for a degree or diploma in any other University or Institute of higher learning has been incorporated without acknowledgement. I reserve the right to incorporate this material, in whole or in part, into my future works.

Signature: A.Keerththipan Date: 20.04.2023

The above candidate has carried out research for the Masters thesis under my supervision. I confirm that the declaration made above by the student is true and correct.

Name of Supervisor: Dr. KASN Sumathipala

Signature of the Supervisor: Date:

DEDICATION

This thesis is dedicated to my parents, whose constant support and inspiration have been the inspiration for my academic endeavors. I will always be grateful for their love, support, and sacrifices since they helped to mold me into the person I am today.

A special word of thanks should also go out to my boss, Dr. KASN Sumathipala, for his important advice, mentoring, and support during my academic career. I am sincerely appreciative of his contributions to my academic and personal development since his knowledge, understanding, and encouragement have been crucial in assisting me in achieving my academic objectives.

Finally, I want to express my gratitude to the institution for giving me the tools, spaces, and chances to pursue my academic passions. My perspective on the world has been greatly influenced by the knowledge and experiences I have acquired while attending university, and I will always be appreciative of the chances that have been given to me.

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I would also like to extend my thanks to the Faculty of Information Technology for providing me with the resources and support necessary to pursue my research. The faculty's commitment to academic excellence and its dedication to providing students with the tools and knowledge they need to succeed have been instrumental in my academic and personal growth.

I would also like to thank Senzgaro (Pvt) Ltd for providing me with the IoT support and connecting farms, which was critical to the success of my research. The company's expertise and commitment to innovation have been invaluable in helping me to develop and implement my plant growth monitoring system.

Finally, I would like to thank all the individuals who participated in my research and provided me with valuable insights and feedback. Their contributions have been instrumental in helping me to understand the complexities of plant growth monitoring and to develop an effective solution.

Once again, I express my sincere gratitude to all those who have contributed to my thesis, and I look forward to continuing my research in this exciting field.

ABSTRACT

This research demonstrates the importance of image processing and IoT in plant monitoring systems. The study focused on pest identification using Mobilenet_v2 and Resnet_v2_50 models trained with data sets of five pests. The accuracy was 92.12% and 82% respectively, but it can be improved by adding more data sets and using preprocessing techniques. The identification of pests can help farmers take the appropriate actions to increase production. The research also utilized YoloV4 and augmentation methods for semantic and instance segmentation, achieving a 54.76% mAP on the test set, demonstrating the reliability of physical indicators of plant pathogens. The proposed system is efficient and simple, and the accuracy can be improved by using different image processing techniques. The study suggests that image processing techniques and IoT can be crucial in plant monitoring systems, leading to increased productivity and food quality.

Keywords: Image processing, IoT, Mobilenet_v2, Resnet_v2_50, YoloV4, ESP32-CAM

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List of Abbreviations

Abbreviation	Description
ACM	Association for Computing Machinery
GDP	Gross domestic product
IoT	Internet of Things
ML	Machine learning
CNN	Convolutional Neural Network
PCA	Principal Component Analysis
MQTT	Message Queuing Telemetry Transport
YOLOv4	You Only Look Once version 4
OpenCV	Open Source Computer Vision Library
ANN	Artificial neural networks
DNN	Deep Neural Networks
DAE	Denoising Auto Encoder
FDR	False Discovery Rate
TNR	True Negative Rate
WSN	wireless sensor network
SVM	Support vector machines
FNR	False Negative Rate
PSNR	Peak signal-to-noise ratio
NPV	Negative Predictive Value
IoU	Intersection-over-Union
mIoU	Average Intersection over Union
mAP	Mean Average Precision
TPR	True Positive Rate
TP	True positive
FP	False positive

List of Appendices