I.M.B.A.S.: INTEGRATION OF FFB RIPENESS DETECTION SYSTEM

AHMAD SYAZWAN RAMLI; MOHD AZWAN MOHD BAKRI; MOHD RIZAL AHMAD; NABILAH KAMALIAH MUSTAFFA; MOHD JURAIME JUSOH; MOHAMAD FAUZI ISMAIL and MOHAMMAD ELYAS SARPON

861

MPOB INFORMATION SERIES • ISSN 1511-7871 • JUNE 2025

MPOB TT No. 692

The technology is a combination of system and suitable hardware for an artificial intelligence (AI) based image processing for detecting oil palm FFB ripeness, achieving high-accuracy geo-tagging, and efficient data management.

INTRODUCTION

The manual harvesting of oil palm fresh fruit bunches (FFB) is labour-intensive, prone to human error, and inefficient due to inconsistent ripeness assessments, labour shortages, and the challenges of inspecting dense canopies. Traditional methods rely on visual inspection, leading to suboptimal harvest timing, reduced oil yield, and increased operational costs.

The integration of AI for the detection of oil palm fresh fruit bunches (FFB) ripeness also includes a palm tagging and identification system. This technology uses customised machine learning algorithms to analyse FFB images captured by the drone's camera, allowing for the accurate identification and marking of FFB either ripe or unripe, and tag the corresponding tree geolocation (*Figure 1*). The goal of this technology is to improve the efficiency and accuracy of oil palm harvesting, and increase overall productivity in oil palm plantations.

Figure 1. I.M.B.A.S., an AI-based FFB ripeness detection system.

By leveraging machine learning and real-time image analysis, the system aims to accurately classify FFBs as "Ripe" or "Unripe/Harvested," reducing reliance on manual labour and minimising human error. This technology seeks to optimise harvest scheduling, improve yield and quality, and enhance operational efficiency by providing real-time, scalable, and data-driven insights for plantation management.

NOVELTY OF THE TECHNOLOGY

The technology utilises drones for example, equipped with AI-based image recognition to detect ripe fresh fruit bunches (FFB) in oil palm plantations (*Figure 2*). The drone captures high-definition images and video feeds of the plantation, which are processed in real time by a custom AI algorithm to classify FFBs as "Ripe" or "Unripe/ Harvested" based on visual cues like colour and texture.

Figure 2. Integration of I.M.B.A.S. with a common commercially available drone.

The system assigns GPS coordinates and unique IDs to each tree, storing the data locally and synchronising it with a cloud-based platform. A web dashboard visualises the data, enabling plantation managers and harvesters to access real-time ripeness information for optimised harvesting (*Figure 3*). The intellectual property (IP) status of this technology is currently under ongoing filing, with efforts being made to secure patents.

Figure 3. Identified palm trees with ripe FFB marked with red colour in dashboard map.

BENEFITS AND ADVANTAGES

- Automates the detection of ripe FFBs, reducing manual labour on time spent for inspections;
- Provides immediate feedback on ripeness status, enabling timely harvesting decisions;
- Reduces labour costs and increases overall plantation productivity by optimising harvesting operations;
- GPS coordinates and tree IDs allow for precise tracking and management of plantation assets;
- Ensures data is securely stored and easily accessible for plantation managers through a web-based dashboard; and
- Easily adaptable to different plantation sizes, making it a versatile tool for the agricultural industry.

COMMERCIALISATION POTENTIAL

While the initial investment may be substantial, the long-term benefits of reduced labour costs and improved yield make the system economically viable, with ROI achievable within a few harvest cycles. The system has strong commercialisation potential due to the growing global demand for palm oil and the need for more efficient and sustainable farming practices. Its scalability allows it to be applied across plantations of various sizes, making it attractive to a wide market. Commercial opportunities include partnerships with drone manufacturers, agritech companies, as well as a service-based subscription model for plantation owners.

CONCLUSION

In conclusion, I.M.B.A.S. represents a groundbreaking advancement in oil palm plantation management, offering increased efficiency, reduced labour costs, and improved harvesting accuracy. Its potential for commercialisation and global scalability positions it as a valuable solution for the future of sustainable agriculture.

REFERENCES

Dharma, A. G., Purnama, I., & Bangun, B. (2024). Implementation of convolutional neural network algorithms to detect the ripeness of palm fruits based on image colors. *International Journal of Science, Technology & Management, 5*(4), 916–922. https://doi.org/10.46729/ijstm.v5i4.1153

Jupriyanto, Bura, R. O., Apriyani, S. W., Ariwibawa, K., & Adharian, E. (2018). UAV application for oil palm harvest prediction. *Journal of Physics: Conference Series, 1130*, 012001. https://doi.org/10.1088/1742-6596/1130/1/012001

Saeed, O. M. B., Sankaran, S., Shariff, A. R. M., Shafri, H. Z. M., Ehsani, R., Alfatni, M. S., & Hazir, M. H. M. (2012). Classification of oil palm fresh fruit bunches based on their maturity using portable four-band sensor system. *Computers and Electronics in Agriculture, 82*, 55–60. https://doi.org/10.1016/j.compag.2011.12.010

Sastrohartono, H., Suryotomo, A. P., Saifullah, S., Suparyanto, T., Perbangsa, A. S., & Pardamean, B. (2022). Drone application model for image acquisition of plantation areas and oil palm trees counting. *2022 International Conference on Information Management and Technology (ICIMTech)*, (pp. 167–171). IEEE. https://doi.org/10.1109/icimtech55957.2022.9915223

Shaarani, S. M., Cárdenas-Blanco, A., Amin, M. H. G., Soon, N. G., & Hall, L. D. (2010). Monitoring development and ripeness of oil palm fruit (*Elaeis guineensis*) by MRI and bulk NMR. *International Journal of Agriculture and Biology, 12*(1), 101–105.

For more information, kindly contact:

Head of Innovation Commercialisation Center, MPOB
6, Persiaran Institusi, Bandar Baru Bangi,
43000 Kajang, Selangor, Malaysia
Tel: 03-8769 4574
Fax: 03-8926 1337
E-mail: tot@mpob.gov.my
www.mpob.gov.my