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WELCOME SPEECH FROM THE CHAIRMAN

RISM 17th International Surveying Conference for Undergraduates (ISCU 2025)

بسم الله الرحمن الرحيم السلام

عليكم ورحمة الله وبركاته

Greetings to all,

It is with great pleasure that I welcome you to the 17th RISM International Surveying Conference for Undergraduates (ISCU 2025), themed *"Embracing Construction Revolution 4.0: Transforming Malaysia's Built Environment."* On behalf of the Royal Institution of Surveyors Malaysia (RISM), I also wish to express our sincere appreciation to Universiti Teknologi MARA (UiTM), Perak Campus, for graciously hosting this significant event.

As we navigate the era of the Fourth Industrial Revolution (IR4.0)—or in our context, Construction Revolution 4.0 (CR4.0)—we are witnessing transformative advancements across the global construction sector. Technologies such as Building Information Modelling (BIM), the Internet of Things (IoT), artificial intelligence (AI), robotics, big data analytics, and cloud computing are redefining the way we build, manage, and interact with our built environment. For Malaysia, embracing CR4.0 is a strategic imperative to achieve our socio-economic and environmental goals.

This conference serves as a vital platform to unite surveying undergraduates from various disciplines, fostering critical dialogue on industry challenges, enhancing professional networking, and preparing a new generation of talent for the rapidly evolving construction landscape. It is also an opportunity for employers to engage with and inspire our future professionals.

I would like to extend my heartfelt thanks to all industry speakers, paper presenters, judges, and participants for their time, contributions, and support in making ISCU 2025 a success. I also commend the organising committee for curating a meaningful and dynamic conference experience.

May the knowledge gained, connections formed, and ideas exchanged during this event inspire all participants to lead and innovate in their future endeavours.

Wishing everyone a productive and memorable conference.

Prof. Ts Sr Dr. Adi Irfan Bin Che Ani'
Chairman, Universities' Partnering Committee
RISM Session 2024/2025
May 2025

WELCOME SPEECH FROM CO-CHAIRMAN

RISM 17th International Surveying Conference for Undergraduates (ISCU 2025)

Bismillahirrahmanirrahim.

السلام عليكم ورحمة الله وبركاته and greetings to all.

It is my great pleasure to welcome everyone to the 17th International Surveyor Conference for Undergraduates (ISCU 2025), proudly hosted by Universiti Teknologi MARA (UiTM) Perak Branch in collaboration with the Royal Institution of Surveyors Malaysia (RISM). This event is a meaningful platform for students in the built environment to share ideas, showcase innovations, and build professional networks. We are honoured by your presence and enthusiastic participation, with 135 accepted papers and 78 poster presentations this year.

UiTM Perak, home to the College of Built Environment, has long been a hub for academic excellence in architecture, planning, and surveying. Our commitment remains strong in nurturing competent graduates who meet industry demands and contribute to nation-building.

While you're here, we invite you to experience the heritage and culture of Perak Tengah from the architectural richness of Rumah Kutai to the historical towns of Pasir Salak, Bota, and Kampung Gajah.

To all presenters and winners, congratulations on your achievements. Let your work today be a catalyst for future success and academic growth. We hope this conference will inspire you to explore new ideas, foster collaboration, and make lasting memories.

My deepest thanks to the Royal Institution of Surveyors Malaysia (RISM) and the organising committee for making this event a success.

We hope your experience here will be rewarding and unforgettable.

Thank you. Selamat datang dan selamat berjaya.

Associates Professor Dr. Nur Hisham Ibrahim, *PMP*
Co-Chairman, Universities' Partnering Committee
RISM Session 2024/2025
May 2025

WELCOME SPEECH FROM THE PROJECT DIRECTOR

RISM 17th International Surveying Conference for Undergraduates 2025

Alhamdulillah, all praise to Allah S.W.T. for His guidance and blessings in making the RISM 17th International Surveying Conference for Undergraduates (ISCU) 2025 a reality.

It is with great honour and gratitude that I welcome all participants, guests, academicians, and industry professionals to this prestigious event, proudly organized under the Royal Institution of Surveyors Malaysia (RISM). This 17th edition of ISCU stands as a proud testament to our collective dedication toward academic excellence, professional collaboration, and youth empowerment in the field of surveying.

I extend my heartfelt appreciation to RISM for its unwavering support, to the hardworking ISCU 2025 Organising Committee, and to all 16 partnering universities across Malaysia for their commitment and contributions. Your efforts have shaped this conference into a dynamic platform for knowledge exchange, innovation, and professional growth.

To the academicians and practitioners present, your insights are invaluable in bridging the gap between academic theory and real-world practice. To our undergraduate participants, your passion, curiosity, and commitment are the very foundation of our future. May this conference not only deepen your academic journey but also ignite a spirit of leadership, integrity, and sustainable thinking.

Let this gathering serve as more than an academic milestone. May it foster lifelong networks, inspire transformative ideas, and chart new directions in our shared professional journey.

Wishing everyone a rewarding and inspiring conference experience.

Sr Dr. Nurul Fadzila Zahari
Project Director
RISM 17th ISCU 2025

3D MULTISPECTRAL IMAGING FOR EARLY DETECTION OF DISEASE IN PLANT

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ABSTRACT

Plant diseases can cause serious damage to crop affecting agricultural productivity and food security. Early detection is crucial to prevent their spread and minimise losses. However, traditional methods such as visual inspection are often time-consuming and may not be accurate, particularly in the early stages of infection. This study explores the use of 3D multispectral imaging as an advanced approach to detecting plant diseases by analysing both spectral and structural changes in plants. A UAV equipped with multispectral camera will be used to capture images of selected plant samples. The collected data will be processed using Pix4D and Meshlab to generate 3D model and calculate vegetation indices such as NDVI and NDRE. A ground truth survey will also conduct to compare the imaging results with actual plant conditions. The expected findings indicate that 3D multispectral imaging can detect early symptoms of plant diseases more effectively than traditional methods. The combination of spectral analysis and 3D modelling will provide a clearer understanding of plant health, enabling earlier and more accurate disease identification. Overall, this study can highlight the potential of 3D multispectral imaging as a valuable tool for improving plant disease detection. By integrating this technology into agriculture, farmers can take quicker action to manage plant health and reduce crop losses.

Keywords: Plant Disease Detection, 3D Multispectral Imaging, Unmanned Aerial Vehicle (UAV), Vegetation Indices (NDVI, NDRE)

I. INTRODUCTION

Plant diseases represent a significant threat to global agriculture, affecting crop yield, food security and overall agricultural productivity. Traditionally, plant disease detection has relied on visual inspections conducted by farmers or agricultural experts and laboratory analyses of plant samples (Lárraga-Altamirano et al., 2021). These methods, while effective in some cases, are often time-consuming, labour-intensive and may not provide accurate diagnoses until the disease has progressed. In recent years, technological advancements in remote sensing, imaging and machine learning have introduced innovative approaches for monitoring plant health. One such promising technology is 3D multispectral imaging, which captures images in multiple spectral bands beyond the visible light spectrum, such as the near-infrared (NIR) and ultraviolet (UV). These spectral bands can reveal physiological changes in plants that are not detectable by the human eye such as variations in chlorophyll content, water stress and other indicators of early disease onset. By utilizing this technology, researchers can detect subtle morphological and physiological changes in plants, enabling earlier and more precise disease diagnosis. This paper presents a conceptual analysis of integrating 3D multispectral imaging into agricultural disease detection systems.

II. LITERATURE REVIEW

A. Multispectral Imaging in Agriculture

Multispectral imaging (MSI) has become an important tool in agriculture for monitoring plant health. It captures images in different wavelengths beyond what the human eye can see, allowing early detection of plant stress. One of the most commonly used indices in multispectral imaging is the Normalized Difference Vegetation Index (NDVI), which helps measure the amount of chlorophyll in plants and their overall health (Zhao et al., 2022). Recent studies have shown that UAV-mounted multispectral cameras allow farmers and researchers to quickly scan large areas to detect plant diseases (Ahmed et al., 2022). For example, multispectral imaging has been used to identify fungal infections like powdery mildew by analysing changes in reflectance values in the near-infrared (NIR) spectrum. However, multispectral imaging alone is sometimes not enough because it only provides spectral data and lacks detailed information about plant structure.

B. 3d Imaging in Plant Disease Detection

3D imaging technologies such as LiDAR and Structure from Motion (SfM) are useful for analysing plant shape, size, and structure. These techniques create detailed 3D models of plants, allowing researchers to detect physical changes caused by diseases (Kim et al., 2019). For example, bacterial wilt causes leaves to curl and change shape, which can be detected more accurately using 3D imaging rather than traditional 2D images (Rundo et al., 2017). Studies have shown that when 3D point cloud data is combined with spectral data, the accuracy of disease detection improves (Huang et al., 2023). For instance, LiDAR-based imaging has been used to detect changes in leaf texture, which may indicate early disease symptoms (Nie et al., 2019). This combination helps differentiate between abiotic stress (e.g., drought) and biotic stress (e.g., infections), which often look similar in spectral images alone.

C. *Traditional Vs. Modern Detection Method*

In the past, farmers relied on visual inspections and laboratory tests to diagnose plant diseases. Methods like microscopic analysis, serological tests (e.g., ELISA), and PCR techniques were used to confirm infections, but these methods are often slow and require expert knowledge (Saini, 2019). With recent advancements, remote sensing and machine learning have improved disease detection. Deep learning models can now analyse images from multispectral and 3D sensors to automatically identify diseases (Islam et al., 2017). For example, AI-based disease detection has been applied to crops like tomatoes and bananas, helping farmers take action before diseases spread (Kumar & Shukla, 2022).

D. Integrating Multispectral And 3D Imaging

Recent research suggests that combining multispectral and 3D imaging provides the best results for plant disease detection. Multispectral imaging helps detect biochemical changes, while 3D imaging provides structural details (Wang & Zhao, 2021). Together, these technologies offer a more accurate way to assess plant health. A study by (Kouadio et al., 2023) demonstrated that using UAVs equipped with multispectral and LiDAR sensors helped detect bacterial wilt in tomatoes by analysing both colour changes and leaf curling. This research highlights how combining multispectral and 3D imaging can provide better insights into plant diseases.

X. METHODOLOGY

The methodology is divided into four phases:

A. *Preliminary Study*

Preliminary study is the first step in the research process, where the necessary preparations are made. This includes selecting a suitable study area that is accessible and appropriate for UAV multispectral imaging. Choosing the right location is important to ensure the quality and relevance of the data collected. Additionally, the study requires selecting suitable software for processing and analyzing the images, ensuring it can handle 3D modeling and multispectral image analysis. The hardware needed for the research is also determined in this phase, including a drone equipped with a multispectral camera to capture images in different light bands.

B. *Data Collection*

The data collection phase is an important part of the research where information is gathered to meet the study's goals. This phase includes several key steps. First, planning is done to make sure data is collected in an organized way. This includes deciding how the drone (UAV) will fly to capture images properly. Important factors like altitude (1.5 meters above ground), camera angle (45°), and overlap settings (70% forward, 60% sideways) are set to ensure full coverage of the study area. Next, the study mainly uses primary data, meaning collects fresh data instead of using existing information. This data includes images and multispectral readings captured by the UAV. Finally, a ground truth survey is conducted to check the accuracy of the UAV's data. Visit the study area, inspect the plants for signs of disease or stress, and compare their observations with the drone images. This step ensures that the vegetation indices calculated from the images truly represent the plants' health.

C. *Data Processing*

The data processing phase is an important step in the research where the collected data is organized, analysed, and turned into useful information. This phase includes several key steps. First, image processing is done to prepare the raw images taken by the UAV (drone). Software like Pix4D is used to identify key points in the images and match them together. This helps in properly aligning overlapping images. Next, a process called Automatic Aerial Triangulation determines the 3D positions and angles of the images, allowing for an accurate 3D map of the study area. To further improve accuracy, Bundle Block Adjustment is used to correct any alignment errors and ensure the 3D reconstruction is as precise as possible. After this, a point cloud is generated. A point cloud is a set of data points in space that represents the study area in 3D form. At first, a sparse point cloud is created, which gives a rough 3D outline. Later, Point Cloud Densification adds more points to make the model clearer and more detailed. Once the densified point cloud is ready, it is used to create 3D models of the plants and the surrounding area. At this stage, calculate vegetation indices like NDVI (Normalized Difference Vegetation Index) and NDRE (Normalized Difference Red Edge Index), which help in checking the plant's health and detecting signs of disease.

D. *Data Analysis*

The data analysis phase is where the processed data is examined to determine if the research objectives have been met. In this phase, the findings are presented through different formats, including 3D models and visualisations that provide a clear view of the plants' shape, structure, and health. Additionally, vegetation indices such as NDVI and NDRE are analysed to assess plant health and detect any signs of disease or stress. Statistical analysis is also performed to validate the accuracy of the results. This includes comparing the UAV (drone) data with real-life ground truth observations to ensure that the remote sensing techniques are reliable. Furthermore, statistical correlation is used to evaluate the relationship between vegetation indices and actual plant conditions, helping to measure the effectiveness of multispectral imaging for disease detection. Once the results are presented, they are carefully interpreted to draw meaningful conclusions. The study examines early signs of disease, identifying patterns or abnormalities in the data that indicate potential plant health issues.

CONCLUSION

In conclusion, the early detection of plant diseases plays a critical role in maintaining food security and promoting sustainable agricultural practices. Although significant advancements have been made in plant disease detection technologies, there are still gaps in the literature regarding the practical application of tools like 3D multispectral imaging. This research aims to address these gaps by exploring the effectiveness of this technology in real-world agricultural settings, assessing its ability to detect various plant diseases across different growth stages. By integrating 3D multispectral imaging with other data collection techniques, such as ground truthing and environmental monitoring, this study seeks to provide a more comprehensive understanding of the technology's potential and limitations. The findings from this research could contribute significantly to the field of surveying science and geomatics, offering practical solutions for farmers and the broader agricultural industry in their efforts to improve crop management and reduce the impact of plant diseases.

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