Cawangan Perak

ISCU 2025

17TH RISM INTERNATIONAL SURVEYING CONFERENCE FOR UNDERGRADUATES

Embracing Construction Revolution 4.0 (CR4.0): Transforming Malaysia's Built Environment

16th - 17th May 2025 I Friday - Saturday

E-ISBN PROCEEDING

VOLUME I

Published by
Royal Institution of Surveyors Malaysia
3rd Floor, Bangunan Juurukur
64 & 66, Jalan 52/4
46200 Petaling Jaya
Selangor

E- PROCEEDING 17th RISM ISCU 2025 Volume 1

Editors: Lizawati Abdullah, Nor Suzila Lop, Nor Nazihah Chuweni, Suriani Ngah Abdul Wahab, Hasnan Hashim

eISBN 978-629-94789-0-4

9 786299 478904

(online)

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

INTEGRATING UNMANNED AERIAL VEHICLE (UAV) WITH GPS DATA COLLECTION TO MONITOR WATER TANK

Azri Iman Farhan Bin Rithaudin[1], Munirah Radin Mohd Mokhtar[2*],
Suzanah Abdullah[3], Izrahayu Che Hashim[4], Haslina Hashim[5].

[1,2*,3,4,5]Program of Surveying Science and Geomatics,
Department of Built Environment Studies and Technology, Faculty of Built Environment,
Universiti Teknologi MARA Perak Branch, Perak, MALAYSIA.
Email: munirah@uitm.edu.my

ABSTRACT

Unmanned Aerial Vehicle (UAV) technology offers a competent method for monitoring and mapping infrastructure, including water tanks. The integration of Unmanned Aerial Vehicles (UAV) with GPS data collection has transformed water tank monitoring, offering enhanced efficiency and accuracy compared to traditional methods. Conventional inspection techniques are often time consuming, labour intensive, and disposed to human error. This study explores the application of Ground Control Points (GCP) to enhance spatial accuracy and structural assessment using UAV. photogrammetry. A total of 11 GCP were purposefully placed and measured using GNSS RTK. UAV data collection utilized 90° (Nadir), 45° (Oblique), and 0° (Horizontal) camera angles to capture comprehensive imagery for top view mapping, 3D modelling, and structural analysis. Preliminary results indicate that UAV based monitoring provides a cost-effective and accurate alternative to physical inspections. The high-resolution imagery and GPS data integration enabled precise mapping of water tank locations, detection of structural defects, and analysis of water levels over time. Furthermore, the automation of data collection reduced operational risks and improved the overall efficiency of water resource management. In conclusion, integrating UAVs with GPS data collection enhances water tank monitoring by providing real-time, accurate, and reliable geospatial information.

Keywords: Unmanned Aerial Vehicle (UAV), Ground Control Points (GCP), Monitoring, Angle, High-resolution

V. INTRODUCTION

B. Unmanned Aerial Vehicle (UAV) For Monitoring

An Unmanned Aerial Vehicle (UAV), or drones, are aircraft that operate without a human pilot and are equipped with technologies like GPS, cameras, sensors, and advanced tools such as thermal imaging, LiDAR, and multispectral cameras. They are widely used in industries like agriculture, construction, environmental monitoring, and building inspection due to their ability to capture high-resolution data, access hard-to-reach areas, and provide real-time analysis. UAVs play a crucial role in structural inspections by detecting cracks, deformations, or damage, particularly in complex structures like water tanks. Through photogrammetry, they create 3D models for detailed analysis, aiding in repairs and renovations, while also inspecting building facades for damage or wear. UAV are commonly used for structural inspection, where they identify cracks, deformation or damage on building surface. This is particularly useful for complex structures such as water tank. With photogrammetry, UAV can create 3D models of building enabling detailed structural analysis and aiding in planning repairs or renovation. UAV also inspect building facades, especially glass or intricate surface, to identify damage or wear. Flight planning applications allow the design of automatic flights with the previously determined parameters. However, these should be discarded for two reasons. The accuracy of UAV applications depends on GNSS quality, which can be affected by sensor performance and satellite signals, potentially causing errors in short-range imaging. Photogrammetric reconstruction improves with higher image overlap and proper registration. Operators should maintain consistent speed and capture intervals, ensuring horizontal image sequences with optimal overlap for better results. *(Krawczyk, J. M. (2015))*

C. Ground Control Points (GCP)

Unmanned Ground Control Points (GCP) are essential for ensuring the accuracy of geospatial data from UAV flights. These fixed points, determined by using RTK surveying, help correct and align aerial imagery by improving positional accuracy, which standard UAV GPS alone cannot achieve. In photogrammetry, GCP enhances the precision of orthophotos and 3D models by reducing errors and distortions caused by flight altitude variations or sensor limitations. Photogrammetry software like Pix4D uses GCP to accurately align images, with greater accuracy achieved by increasing and even distributing GCP across the survey area. This makes UAV data highly reliable for applications requiring high geospatial precision, such as structural monitoring and digital surface modeling.

VI. OBJECTIVES OF STUDY

a) To monitoring the water tank in UiTM Perak Branch Seri Iskandar by using Unmanned Aerial Vehicle (UAV).

b) To investigate the surface of water tank by demonstrate 3D model.

VII. LITERATURE REVIEW

A. Monitoring of deformation processes in building

From research, the construction of buildings in a metropolis has its own, very bright and important features, which are mainly associated with the intensification of construction and complicated design of the buildings themselves. Monitoring of deformation processes in building and structures in metropolises by M.G.Mustafin in 2017. Study area is building on the Novosmolenskaya Embankment in St.Peterbury by using terrestrial laser scanning (TLS). Displacement benchmarks put on the controlled object and the geometrical measurements of pits length 20-100m, width 4- 100m, depth 3-20m. Measurements of very high accuracy (less than 1 mm) using software to process SAGA LIS PRO 3D. Thus, quite a reasonable solution to this is to control the deformation process of the earth's surface near the object under construction. These observations should be carried out in conjunction with the traditional method.

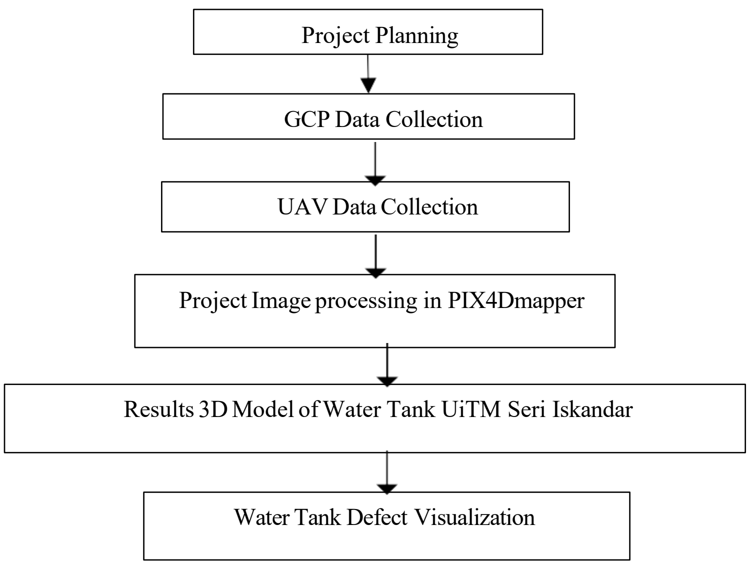
B. Detection of buildings digital surface models deformation generated from drone nadir images

From research is an assessment of landslide-induced displacement and deformation of above-ground objects using UAV-BORNE and airborne laser scanning data by T.Zieher in 2019. Automatic tracking total station, UAV-borne laser scanning, Air borne laser scanning. The Vogelsbery landslide is in the province of Tyrol (Austria) and a minimum point density of at least 8 points per square meter were demanded. Proximately 500m can be described as a rock slump and its measurement distances range between about 600 to 1700m and software it uses is SAGA LIS PRO 3D.

VIII. METHODOLOGY

D. Introduction

This project focuses on the assessment and defect detection of a water tank located at UiTM Perak, Branch Seri Iskandar by using Unmanned Aerial Vehicle (UAV) based photogrammetry approach, integrated with 4D modelling and defect visualization of water tank. The project follows a systematic workflow as outlined below:



A. Project planning

Figure 3 Water Tank UiTM Perak, Branch Seri Iskandar

The selected of study area is the water tank of UiTM Perak Branch Seri Iskandar. For UAV data collection the SJI Phantom 4 with RTK was used. And for the Ground Control Points (GCP) collection Satlab Base and Rover GNSS equipment were utilized to support the GCP verification in the field. All the collected data were then processed using Pix4Dmapper software to generate output of Orthophoto of map and the 3D model of water tank.

B. Ground Control Points (GCP) data collection

The first step in setting up Ground Control Points (GCP) is identifying their locations within the study area to serve as reference points for accurate data collection. Precise positioning ensures proper alignment of survey data at coordinates (4°21'16.06"N, 100°57'26.00"E). The GNSS was turned on and connected to a controller device, and coordinates were recorded at each designated point, ensuring a fixed solution for accuracy. All data were carefully saved to streamline analysis and mapping, ensuring reliable and consistent results for surveying projects.

C. Unmanned Aerial Vehicle (UAV) data collection

The DJI Phantom 4 played a pivotal role as the primary aerial platform for data collection and surveying task. Equipped with a 20-megapixel camera and a 1-inch CMOS sensors, it delivered high-resolution still images and 4K video footage, essential for detailed mapping and inspection purposes. With a flight time of up to 30 minutes per battery charge and intelligent flight modes such as Point of Interest and Waypoints, the Phantom 4 facilitated efficient data collection, significantly enhancing geospatial analysis and mapping outcomes.

- UAV flight path planning and mission using DJI Pilot application
  The water tank KMZ file containing the light plan was uploaded into the application to cover the entire study area comprehensively. Flight parameters such as altitude, speed and image overlap were then adjusted to ensure complete coverage and precise data acquisition. The flight mission was programmed and saved, preparing it for execution. This setup ensured all Ground Control Points (GCP) were adequately captured, enabling effective data collection and accurate geospatial analysis.

D. Image processing in Pix4Dmapper

Pix4D Mapper was utilized as the primary software for advanced monitoring, analysis and planning of the physical product or process. In this project, it was applied to generate a detailed 3D model with precise coordinates, enhancing the building inspection process. The raw images used were captured through aerial photogrammetry, ensuring high accuracy and reliable results.

- Import image into Pix4Dmapper

A total of 408 images in 29/11/2024 were enhanced and important into Pix4D Mapper. The datum and coordinated system of the images were verified to be set to WGS 1984 and WGS 84. This template enabled the generation of a high-quality 3D model with reliable output and moderate processing speed, producing results such as a 3D Mesh and point cloud. Once the images were imported, they were displayed as red dots on the map within Pix4D Mapper. The workflow involved three main stages: initial processing, point generation, and the orthomosaic process, culminating in the creation of the 3D model.

- Initial processing

The initial processing stage in creating a 3D model using Pix4D Mapper begins with employing photographs and Ground Control Points (GCP). This stage focuses on extracting key points, which are unique features identified in the images. These key points are then matched across overlapping images to determine common features and establish relationship between the images. During the initial processing, specific settings are adjusted to ensure the best results. In the General tab, the “Full Key points Image Scale” option is chosen to include all image scales for identifying features. In the Matching tab, the "Accurate Geolocation and Orientation" method is used. This step ensures that image is correctly positioned and aligned using GPS data and Ground Control Points (GCP), making the model accurate and well-referenced.

- Points Clouds and Mesh

The points cloud and mesh processing, where processing parameters could be adjusted to achieve the desired results for the generated point cloud. This stage involved three tabs: Point Cloud, 3D Texture Mesh and advanced. In the Point Cloud tab, an image scale of 1/2 (half image size) was selected as the recommended option for point cloud densification. The "classify point cloud" option was enabled to enhance the generation of the Digital Terrain Model (DTM) while the other setting were left at their default values. In the 3D Texture Mes tab, a medium resolution was chosen to balance the project size, processing time and including a "9x9" pixel Matching Window Size for point cloud densification. This ensured the accurate placement of densified points by preserving their adjacency to the original points in the images.

- DSM, Orthomosaic and Index

Lastly, the DSM, Orthomosaic, and Index processing sections were used to configure the resolution, filter and raster for the DSM and Orthomosaic. This step included three tabs: DSM and Orthomosaic, Additional Outputs and Index Calculator. During this Process, all Orthomosaic options were selected, while the default setting was left unchanged for the other parameters.

IX. RESULTS AND DISCUSSION

A. Ground Control Points (GCP) data collection by RTK (Base & Rover)

In this project, a total of 11 Ground Control Points (GCPs) were collected using the Real-Time Kinematic (RTK) method with a Base and Rover setup. These GCPs were strategically positioned to surround the water tank area, ensuring accurate georeferencing and enhancing the overall precision of the UAV data collection process

Table 6 Show the coordinate all of GCP

Name	Latitude	Longitude	Height
GCP1	0.075998	1.762042	24.5004
GCP2	0.076003	1.762042	24.8726
GCP3	0.076008	1.762036	26.0049
GCP4	0.076011	1.762037	26.9428
GCP5	0.076007	1.762041	27.0803
GCP6	0.076	1.76204	27.5307
GCP7	0.076	1.76204	27.6436
GCP8	0.076	1.762036	27.8363
GCP9	0.076001	1.762033	29.316
GCP10	0.07601	1.762031	23.2363
GCP11	0.076005	1.762028	23.1421

B. The 3D Model of Water Tank

In this project, there were 2 results processed by Pix4D Mapper; point clouds and 3D mesh. The results were presented separately, but the 3D model would have been more appealing if the point cloud and 3D mesh had been combined. When 3D meshes and points clouds were combined, they formed a large set of high- resolution images that were often processed to create realistic 3D models of the world.

- Result in Point Clouds

Figure 4 results 3D model in point clouds

The 3D model of the water tank was generated from a dense point cloud comprising billions of data points, each defined by X, Y, and Z coordinates. These points also include RGB values and other attributes, ensuring a detailed and accurate representation of the structure. Ground Control Points (GCP) were collected using RTK (Base & Rover) to enhance spatial accuracy in the model.

- Results in DSM, Orthomosaic and Index

Figure 5 Results in DSM, Orthomosaic and Index

Figure 3 shows the 3D model of the water tank after processing the Digital Surface Model (DSM), Orthomosaic, and Index. The model accurately represents the structure in shape, size, and spatial details, providing a geospatially precise and detailed visualization of the water tank.

- The 3D model of water tank

Figure 6 Results 3D model of Water tank

The 3D model of the water tank, generated through DSM, Orthomosaic, and index analysis, provides a geospatially accurate and detailed representation. Its high-resolution detail enables clear visualization from multiple angles, making it ideal for structural analysis and geospatial studies.

C. Guideline of Defected from Royal Institution of Surveyor Malaysia (RISM)

- Condition Assessment

CONDITION	SCALE VALUE	DESCRIPTION (VALUE)
1	New / as new	Minor Servicing
2	Fair	Minor repair
3	Poor	Major repair/Replacement
4	Very poor	Malfunction
5	Dilapidated	Damage/Missing

- Priority Assessment

CONDITION	SCALE VALUE	DESCRIPTION (VALUE)
Normal	1	Functional, only cosmetic defect
Routine	2	Minor defects, but can lead to serious defects if left unattended
Urgent	3	Serious defect, cannot function to an acceptable standard
Emergency	4	Element/structure does not function at all: OR Risks that can lead to fatality and/or injury

- Matrix

NO.	MATRIX	SCORE
1	Plan Maintenance	1 to 4
2	Condition Monitoring	5 to 12
3	Serious Attention	13 to 20

- Overall Building Rating

CONDITION	SCALE VALUE	DESCRIPTION (VALUE)	COLOUR
1	Good	1 to 4	
2	Fair	5 to 12	
3	Dilapidated	13 to 20	

D. Water tank defect visualization

Figure 7 3D model of water tank from front side

Table 7 Table defect of water tank

NO	ELEMENT/ COMPENENT	DESCRIPTION	CONDITION	PIRORITY	MATRIX	CALOUR

1	Plumber	Rust	3	2	6	
2	UiTM logo	Tone colour	3	1	6	

Based on Guideline of defect from Royal Institution of Surveyors Malaysia (RISM) the water tank has only minor defects. These include the fading of the UiTM logo and the presence of rust in the water tank pipe. While these issues do not pose an immediate safety concern, they still require regular maintenance to prevent further deterioration and ensure the long-term functionality and structural integrity of the water tank.

CONCLUSION

This study was successful in producing a detailed 3D model and identifying the various damages present on the water tank at UiTM Perak Branch, Seri Iskandar, through the use of Unmanned Aerial Vehicle (UAV) data collection. The 3D model provided an accurate and comprehensive visual representation of the water tank's structure, enabling a thorough assessment of its current condition. The observed damage to the water tank is primarily caused by unpredictable weather conditions, including extreme heat during the summer and prolonged exposure to moisture during the rainy season. These environmental factors significantly contribute to the acceleration of corrosion on the water tank's metal surfaces. The combination of fluctuating temperatures and high humidity levels weakens the structural integrity of the tank over time, leading to issues such as rust formation, paint deterioration, and potential metal fatigue. Such conditions not only compromise the tank's durability but also pose safety risks if left unaddressed. Furthermore, this research highlights the effectiveness of UAV technology as a modern method for monitoring water tank damage. The UAV's ability to capture high-resolution images from various angles allows for precise damage detection, even in hard-to-reach areas that would be challenging and hazardous for human inspectors to access manually. The use of UAVs not only improves the efficiency of the inspection process by significantly reducing the time required for data collection but also enhances safety for personnel from the Facility Management Division (BPF). Inspectors can conduct thorough assessments remotely, minimizing the need for physical climbing or exposure to potentially dangerous structural conditions. Overall, this study demonstrates that UAV technology is a reliable, efficient, and safe tool for infrastructure monitoring and maintenance planning.

ACKNOWLEDGMENT

All praise to Allah SWT for His blessings and strength, which have enabled me to successfully complete this project. I would like to express my sincere gratitude to my supervisor, Dr. Munirah Radin binti Mohd Mokhtar, for his invaluable support and guidance throughout this project. My appreciation also goes to the lecturers and faculty members for their knowledge and assistance in facilitating this research.

A heartfelt thanks to my family and friends for their unwavering encouragement and support. I am also grateful to those who provided access to essential data and tools, such as Landsat 8 imagery and the USGS Spectral Library. To everyone who has contributed, directly or indirectly, I am truly thankful.

REFERENCES

Krawczyk, J. M., Mazur, A. M., Sasin, T., & Stokłosa, A. W. (2015). Infrared building inspection with unmanned aerial vehicles. Prace Instytutu Lotnictwa, 3 (240), 32-48.

ROYAL INSTITUTION OF SURVEYORS MALAYSIA

UNIVERSITI TEKNOLOGI MARA

Cawangan Perak

eISBN 978-629-94789-0-4

9 786299 478904

(online)