



Data Management and System Integration for the Mechanical and Electrical Information System (MECHIS) at Ingenious Technology Solutions

¹Nurul Hidayah Nasron, ^{2,*}Wan Khadijah Wan Sulaiman & ³Nurul Atikah Rosshidi

^{1,2}Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA,
40450 Shah Alam, Selangor, Malaysia

³Ingenious Technology Solutions Sdn. Bhd., No. 7, Jalan Kelisa Emas 3, Taman
Kelisa Emas, 13700 Seberang Jaya, Pulau Pinang, Malaysia

¹2021816634@tudent.uitm.edu.my

^{2,*}wankhadijah@uitm.edu.my

*Corresponding author

Received: 3/2/2025

Revised: 11/3/2025

Accepted: 31/3/2025

Published: 8/4/2025

ABSTRACT

This technical report details an industrial study conducted within the IT Department of Ingenious Technology Solutions Sdn. Bhd., an organization specializing in software development, Artificial Intelligence (AI), and Internet of Things (IoT) integration. The primary objective of this study was to manage, extract, and integrate complex data sets into the Mechanical and Electrical Information System (MECHIS). MECHIS is a specialized system designed to monitor SCADA data transmitted by remote terminal units (RTUs) and manage infrastructure assets for Jabatan Pengairan dan Saliran (JPS) nationwide. The methodology encompassed extensive data mapping, where legacy data from PDF reports was cleaned, structured, and uploaded into the MECHIS database using Microsoft Excel. Additionally, User Acceptance Testing (UAT) was conducted on the mobile version of the MECHIS platform to evaluate interface responsiveness and data synchronization. The results demonstrated that systematic data categorization across four geographical zones significantly improved asset management accuracy. Furthermore, mobile testing identified critical UI/UX bottlenecks, ensuring a more reliable user experience prior to deployment. The integration of these technical and analytical processes ultimately optimizes national infrastructure monitoring and drives evidence-based decision-making for stakeholders.

Keywords: Data mapping, Information systems, MECHIS, SCADA, Software development.

INTRODUCTION

Ingenious Technology Solutions Sdn. Bhd. is a Malaysia-based technology company that specializes in software development and the delivery of innovative services tailored to client needs. A significant focus of the organization's operations involves analyzing, categorizing, and training data for seamless integration with the Internet of Things (IoT) and Artificial Intelligence (AI). The company fosters a highly innovative environment that encourages technological advancements and continuous

professional growth.

The IT Department oversees the management of the organization's information systems and technology infrastructure. A major ongoing project within this department is the development of the Mechanical and Electrical Information System (MECHIS) for Jabatan Pengairan dan Saliran (JPS). MECHIS is designed to monitor and record SCADA data transmitted by remote terminal units (RTUs), as well as to comprehensively manage mechanical and electrical (M&E) asset information across the country.

To ensure the system functions correctly, vast amounts of legacy infrastructure data must be cleaned, structured, and integrated into the new database. Therefore, this study was conducted to execute precise data mapping, asset classification, and mobile interface testing. By leveraging data analysis tools and rigorous testing methodologies, this initiative aims to enhance the reliability of the MECHIS platform and streamline operational reporting for stakeholders.

THE PROPOSED METHOD

Data Extraction and Mapping

The foundational step involved extracting unstructured legacy data from the "Laporan Kajian" PDF files and structuring it within Microsoft Excel. This process was systematically carried out across four designated zones spanning multiple states in Malaysia:

- Zone 1: Perlis, Sabah, and Labuan.
- Zone 2: Kelantan, Perak, Terengganu, and Sarawak.
- Zone 3: Pahang, Johor, Melaka, and Negeri Sembilan.
- Zone 4: Selangor, Kedah, Kuala Lumpur, and Pulau Pinang.

Ten specific columns were created in Excel to efficiently organize the extracted data. During mapping, discrepancies in station names were identified; short abbreviations in the old data were updated to their full official names in the new columns. Additional columns for "Premises" and "Stations" were inserted to expand the dataset's comprehensiveness (See Figure 1).

Component Classification and System Integration

Once cleaned, the data components were linked to 14 specific classifications, comprising 7 fixed assets and 3 non-fixed asset categories, using Excel hyperlinks (See Figure 2). The structured data was subsequently uploaded to the MECHIS website. Station data (e.g., states, IDs, vendors) was uploaded under the Station Management module, while technical asset data was entered under the Field Management module (See Figure 3 and Figure 4).

Mobile Functionality Testing

Post-integration, the mobile version of the MECHIS platform was rigorously tested for responsiveness and usability. The testing parameters included evaluating module accessibility, data input workflows, information retrieval, and data synchronization functions across the mobile interface.

Figure 1

New Excel Column for Stations Number and Premises

A	B	C	D	E	F	G
	NEW	STATIONS		PREMISE		
jh-tcg-001	Pintu Air 5 Pintu Air	SJ-TK-G030			1f10c021d	johor
jh-tcg-002	Pantai Lay Pintu Air	PJ-TK-G031			4ea0b0a8	johor
jh-tcg-003	Parit Jawa Pintu Air	PJ-MU-G060 (A)/J-MU-G062(B)			8667f36b1	johor
jh-tcg-004	Parit Kedo Pintu Air	PJ-MU-G051			87ebd198	johor
jh-tcg-005	Parit Rabu Pintu Air	PJ-MU-G059			c78fd4c25	johor
jh-tcg-006	Gate F Sar Pintu Air	CJ-MU-G045			f5136d5cc	johor
jh-tcg-007	Barrage Ss Pintu Air	TJ-MU-G047			da331ca4	johor
jh-tcg-008	Parit Kuda Pintu Air	PJ-BP-G022			505686d4	johor
jh-tcg-009	Parit Besa Pintu Air	PJ-BP-G015			be2e0fc4e	johor
jh-tcg-010	Parit Sepa Pintu Air	PJ-BP-G023			75a7bf03e	johor
jh-tcg-011	Sungai Kaj Pintu Air	SJ-BP-G016			a46c1bbbi	johor
jh-tcg-012	Parit Johai Pintu Air	PJ-BP-G005			6cfe7ef39	johor
jh-tcg-013	Parit Soga Pintu Air	PJ-BP-G026			ea2da8fb7	johor
jh-tcg-014	Parit Binta Pintu Air	PJ-BP-G028			bd79c9eb	johor
jh-tcg-015	Bakau Cor Pintu Air	EJ-BP-G002			edc4e5f2c	johor

Figure 2

Component After Mapping

Components after mapping
Radial flow pump, Submersible Centrifugal, Split casing horizontal
Mixed Flow Pump
Screw Pump, Archimedian Screw Pump
Penstock
Vertical gate, Roller gate, Water gate
Slide gate
Radial gate, MS Radial
Tilting gate
Hydraulic Hoist
Screwdown gate
Wire Rope Hoist
Spindle
Adrive Gate
Flag Gate

Figure 3

MECHIS System interface

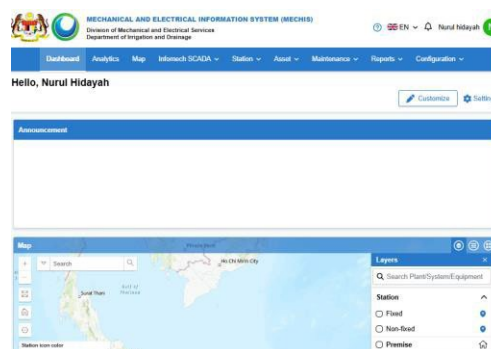
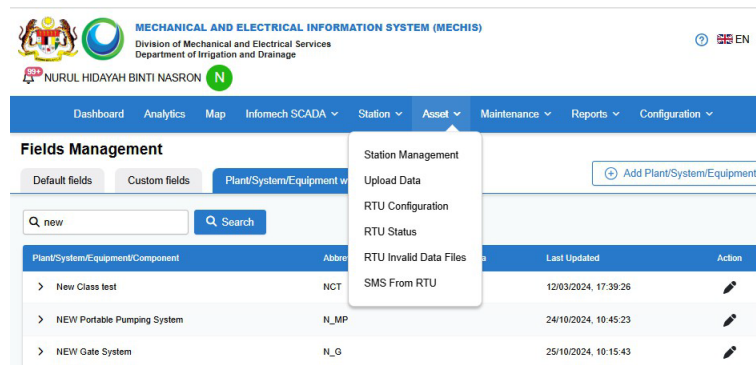


Figure 4

Station Management module



EVALUATION AND RESULTS

Data Integration Outcomes

The systematic mapping and extraction processes were completed successfully across all four zones, resulting in a highly organized and comprehensive dataset. Aligning the "Stations" and "Premises" data provided a clearer operational overview of each JPS station's location, drastically improving the dataset's usability for future analytical tasks. Although the process was occasionally hindered by missing information and illegible writing within the legacy PDF files, the final integration into the MECHIS platform ensured that all technical asset fields were accurately populated.

Mobile Testing Performance

The User Acceptance Testing (UAT) for the mobile version of MECHIS confirmed that the system performed well in terms of overall navigation and accessibility. However, the testing phase successfully identified minor but critical UI/UX bugs. Specifically, it was noted that the on-screen keyboard obscured the background interface during data input, making it difficult for users to view their typed entries. Documenting and reporting these inconsistencies ensured that the development team could patch the issues, guaranteeing a reliable user experience upon the final mobile deployment.

Stakeholder Engagement and Presentation

The accuracy of the processed data was put to the test during multiple outstation meetings with JPS Ipoh. During these high-level discussions, the newly mapped MECHIS data assets were presented, and complex technical queries from stakeholders were directly addressed. This direct engagement not only validated the integrity of the data extraction phase but also contributed significantly to the ongoing development and deployment of the MECHIS project.

CONCLUSION

The technical assignments executed at Ingenious Technology Solutions Sdn. Bhd. bridge the critical

gap between raw data analysis and practical software deployment. By meticulously extracting, cleaning, and mapping infrastructure data from legacy PDFs into the MECHIS database, the reliability and accuracy of national asset tracking for JPS were greatly enhanced. Furthermore, the proactive mobile functionality testing identified user interface bottlenecks that could have impeded field operations, proving that rigorous QA testing is vital in software development lifecycles. Moving forward, it is recommended that organizations adopt Optical Character Recognition (OCR) or AI-based extraction tools to automate the transfer of data from illegible PDFs, thereby reducing manual entry time and minimizing human error. Overall, this study underscores the importance of structured data management in building robust Information Systems for large-scale engineering applications.

ACKNOWLEDGEMENT

The author extends profound gratitude to Universiti Teknologi MARA for supporting this work. The author would like to express heartfelt gratitude to Ingenious Technology Solutions Sdn. Bhd. for the opportunity to participate in the MECHIS project during this industrial training. This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of Interest

The authors have no conflicts of interest to declare.

Non-funded

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

REFERENCES

Ingenious Technology Solutions. (n.d.). *Company Profile and Operations*. Retrieved from internal documentation.



This is an open access article under the CC BY-SA license (<https://creativecommons.org/licenses/by-sa/4.0/>).