INTERNATIONAL EXHIBITION & SYMPOSIUM ON PRODUCTIVITY, INNOVATION, KNOWLEDGE & EDUCATION

E-PROCEEDING

EXTENDED ABSTRACT

UiTM di hatiku

اوسها تقوى مولايا

E-PROCEEDING
EXTENDED ABSTRACT

Editors

- Prof. Madya Dr. Azlyn Ahmad Zawawi
- Dr. Anis Farawahida Mohd Karim
- Dr. Nursyazwanie Mansor
- Dr. Roshidah Safeei
- Azni Syafena binti Andin Salamat
- Hasniza binti Hassim
- Dr. Nur Zharifah Che Adenan
- Mohd Rozman Mohd Nasir
- Nurfaznim binti Shuib
- Norsyazwani binti Ab Halim

e ISBN 978-967-2948-91-9

9 789672 948919

UiTM Cawangan Kedah

Published by:
Universiti Teknologi MARA (UiTM) Cawangan Kedah
Sungai Petani Campus
08400 Merbok
Kedah
Malaysia

Welcome Message

RECTOR, UITM KEDAH BRANCH

Assalamualaikum warahmatullahi wabarakatuh,

First and foremost, I would like to extend my deepest appreciation to the organising committee of i-SPiKE 2025 for their steadfast dedication and commitment in making this prestigious event a reality. My heartfelt congratulations to the committee for their tireless efforts in ensuring that i-SPiKE continues to grow as a meaningful and impactful platform for academics, researchers, students, and industry players worldwide.

The theme for this year, "Empowering Minds: Bridging Innovation, Knowledge and Education for a Sustainable Future," is both timely and significant. It reflects our shared responsibility to not only embrace creativity and technological advancement, but also to ensure that innovation directly contributes to sustainable development, equitable education, and the well-being of future generations.

i-SPiKE 2025 provides a dynamic platform for showcasing innovations that address real-world challenges while opening new avenues for collaboration, engagement, and inclusivity. By bridging knowledge, innovation, and education, this symposium strengthens our collective capacity to design solutions that empower communities and inspire positive change.
I am truly impressed by the diversity and calibre of participants in this year's event. The projects and ideas presented highlight the extraordinary creativity and determination of our innovators. I am confident that the insights and solutions shared here will pave the way for continuous advancement in teaching, learning, and innovation.

It is my sincere hope that you will find i-SPiKE 2025 an enriching experience, one that sparks new ideas, builds lasting collaborations, and strengthens our shared vision for a sustainable future. To all participants, I wish you every success, and to the winners, my warmest congratulations.
Once again, I thank the organising committee, partners, and contributors for their invaluable support. May i-SPiKE 2025 continue to inspire and empower minds for many years to come.

Professor Dr. Roshima Haji Said
Acting Rector
Universiti Teknologi MARA (UiTM) Kedah Branch

Welcome Message
(i-SPiKE 2025 CHAIR)

It is my great pleasure to welcome you to the 4th International Exhibition & Symposium on Productivity, Innovation, Knowledge, and Education 2025 (i-SPiKE 2025). This year's theme, "Empowering Minds: Bridging Innovation, Knowledge, and Education for a Sustainable Future," reflects our collective commitment to advancing innovation and fostering meaningful collaboration across academia, industry, and communities.

i-SPiKE 2025 provides a platform for scholars, researchers, students, and practitioners from diverse fields to showcase their ideas, share knowledge, and inspire new solutions to global challenges. We extend our sincere appreciation to all participants and contributors whose efforts and dedication have made this symposium possible.
We hope that this e-proceedings serves not only as a record of the innovations presented but also as a valuable resource that continues to inspire long after the event.

Thank you.

Dr Junaida Ismail
Chair
4th International Exhibition & Symposium on Productivity, Innovation, Knowledge, and Education 2025 (i-SPiKE 2025)

PREFACE

The 4th International Exhibition & Symposium on Productivity, Innovation, Knowledge, and Education (i-SPiKE 2025) marks yet another milestone in our ongoing commitment to fostering innovation, creativity, and collaboration across disciplines. Guided by this year's theme, "Empowering Minds: Bridging Innovation, Knowledge and Education for a Sustainable Future," the event provides a dynamic platform for students, educators, researchers, and professionals to share their ideas, showcase their innovations, and engage in meaningful knowledge exchange.

This year, we are pleased to report that i-SPiKE 2025 received approximately 50 initial submissions, with more than 35 projects successfully advancing to final presentation and exhibition. These projects reflect a rich diversity of innovation, ranging from educational technologies, digital applications, and gamified learning tools to sustainable materials, cultural heritage preservation, and community-focused solutions. Collectively, they embody the spirit of bridging innovation and education to address pressing societal and global challenges.

We sincerely thank all participants, reviewers, and committee members for their invaluable contributions in making i-SPiKE 2025 a success. It is our hope that this e-proceedings will not only serve as a record of the ideas and innovations presented, but also as an inspiration for future collaborations and advancements in the pursuit of sustainable knowledge and innovation.

Assoc. Prof. Dr. Azlyn Ahmad Zawawi
Editor-in-Chief, i-SPiKE 2025 Proceedings

TABLE OF CONTENTS

CATEGORY 1

S&T (ACADEMIC)

OPENAIPEROVSKITE: A SMART DASHBOARD FOR SOLAR PERFORMANCE TRENDS OF 2D LEAD-HALIDE PEROVSKITES

Nurul Izzah Hayati Mohd Noor,
Faculty of Data Science and Computing, Universiti Malaysia Kelantan City Campus, Pengkalan Chepa, 16100 Kota Bharu, Kelantan.
izzhhyti45@gmail.com

Hasyiya Karimah Adli,
Faculty of Data Science and Computing, Universiti Malaysia Kelantan City Campus, Pengkalan Chepa, 16100 Kota Bharu, Kelantan.
hasyiya@umk.edu.my

Hasiah binti Salleh
Faculty of Ocean Engineering Technology, Universiti Malaysia Terengganu, 21030 Terengganu, Malaysia.
hasiah@umt.edu.my

ABSTRACT

Perovskite materials are at the forefront of photovoltaic research due to their exceptional optoelectronic properties, tunable band gaps, and low-cost fabrication. While three-dimensional (3D) perovskites achieve high power conversion efficiencies (PCEs), their long-term stability remains a major challenge, particularly under humid conditions. In contrast, wo-dimensional (2D) perovskites offer greater environmental durability but often at the expense of efficiency. To address these limitations, this project introduces OpenAIPerovskite, an AI-powered, web-based dashboard developed using Power BI. The platform integrates curated data from over 1,000 peer- reviewed articles, focusing on fabrication methods, material compositions, and device performance. Key features include dynamic PCE visualisation, parameter-based filtering, and machine learning-driven predictions for efficiency and stability based on user-defined inputs. OpenAIPerovskite enables users to explore and compare experimental data and predictive trends without the need for manual literature review or programming expertise. For instance, users can analyse high-performance devices such as the 20.62% PCE achieved in 2018 using a TiO_2/BAFAPbBrI/Spiro-MeOTAD/gold configuration. Developed at a cost under RM 5,000, the dashboard offers an affordable and accessible alternative to commercial data analysis platforms. This collaborative initiative between Shibaura Institute of Technology, Japan, Universiti Malaysia Terengganu, and an industry partner, bridges academic researchers to make data-driven decisions, minimize experimental trial-and-error, and accelerate the development of stable, high-performance perovskite solar cells.

Keywords: Perovskite solar cells, data visualisation, machine learning, materials informatics

INTRODUCTION

Perovskite materials have gained significant traction in photovoltaics research due to their excellent optoelectronic properties, tunable band gaps, and solution-processable fabrication methods. Lead-halide perovskites have achieved high power conversion efficiencies (PCEs), rivaling those of traditional silicon solar cells. However, the long-term stability of three-dimensional (3D) perovskites remains limited due to their susceptibility to moisture and environmental degradation. Two-dimensional (2D) perovskites with their layered organic-inorganic hybrid structures, have emerged as a promising alternative that offers superior environmental resilience. Despite these advantages, their performance generally lags behind that of 3D counterparts, and the complex relationship between stability and efficiency is not yet fully understood. To address this challenge, AI-powered dashboard was developed to centralise, visualise, and predict solar performance trends in 2D perovskite materials. Built using Power BI and integrated with machine learning tools, the platform compiles data from over 1,000 peer-reviewed journal articles across multiple publications. By transforming raw research outputs into interactive and searchable visualisations, the dashboard enables researchers to explore experimental trends, predict efficiency and stability outcomes, and identify optimal material-fabrication combinations. The result is a cost-effective and scalable solution that reduces dependence on manual data analysis and trial-and-error experimentation, while also democratizing access to advanced materials informatics for students, early-career researchers, and non-technical users.

PROBLEM STATEMENT

Addressing this trade-off requires extensive exploration of material compositions, fabrication methods, and device architectures, traditionally reliant on time-consuming experimentation and exhaustive literature review. Although numerous journal articles report findings on perovskite materials, fabrication techniques, and device designs, this information remains fragmented across multiple platforms. Consequently, identifying meaningful patterns or optimal configurations becomes laborious and inefficient. Researchers often depend on manual literature reviews and trial-and-error experimentation, which slow down material discovery and increase research costs. Furthermore, the limited availability of accessible tools integrating machine learning (ML) restricts researchers' ability to make data-driven predictions regarding key performance metrics such as power conversion efficiency (PCE) and material stability. Existing ML models in the field are typically embedded within academic publications or require advanced programming skills and computational resources that may not be readily available in all research environments.

PRODUCT DEVELOPMENT

The development of the OpenAIPerovskite dashboard aligns with the broader mission of accelerating renewable energy research by addressing the fragmented nature of data within perovskite solar cell (PSC) studies. The overall product development process illustrated in the figure below, involves several key steps:

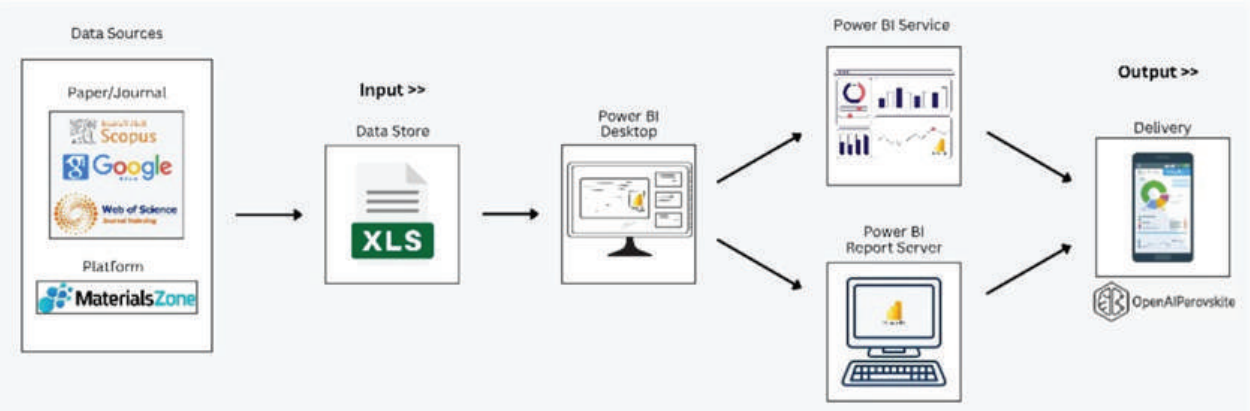

Figure 1. Workflow of the OpenAIPerovskite dashboard development process. Data is sourced from journals and platforms such as Scopus, Google Scholar, Web of Science, and MaterialsZone, and stored in structured Excel formats. These datasets are then processed and visualised using Microsoft Power BI Desktop. The final reports are published via Power BI Service and Power BI Report Server, enabling real-time, interactive access through the OpenAIPerovskite platform for delivery on desktop and mobile interfaces.

Following the workflow illustrated in Figure 1, the development of OpenAIPerovskite involved four major phases:

1. Data Compilation and Validation

An initial dataset was compiled from 1,006 peer-reviewed publications published between 2014 and 2021, with a focused review of 50 experimental articles from 2020 to 2025. After a rigorous selection and validation process, 159 high-quality entries were finalised. These entries concentrate on key performance indicators such as Power Conversion Efficiency (PCE) and device stability, forming the foundation of the dashboard's analytical scope.

2. Data Cleaning and Structuring

All of the datasets were standardised and sanitised to guarantee dependability and uniformity. This involved normalising units across all variables, fixing missing or inconsistent values, and cross-referencing with original publications. The relationships between materials, processing techniques, and performance outcomes were mapped using an entity relationship diagram (ERD), which ensures a relational data structure for scalable analytics.

3. Dashboard Integration

The cleaned dataset was imported into Microsoft Power BI, where it was used to create an interactive and dynamic dashboard. This system allows users to filter and explore multi-dimensional data views, compare device architectures, and monitor efficiency trends, converting

1. Machine Learning Integration

Regression-based machine learning models were used to increase the platform's intelligence. These models can forecast PCE results depending on user-specified input parameters, including fabrication methods or material compositions. Researchers may minimise trial-and-error time, optimise experimental preparation, and model results with the help of this predictive layer.

Product Description

A word cloud, powered by AI text-mining techniques, is integrated into the OpenAIPerovskite platform to visually represent the most frequently reported A-site organic cations used in 2D perovskite solar cells. In this visualisation (Figure 2), prominent cations such as butylammonium (BA), formamidinium (FA), and phenylethylammonium (PEA) appear in larger fonts, indicating their high prevalence across published device architectures. By using the word cloud as one of the AI-powered visualisation tools in this digital era, the dashboard enables researchers to quickly identify dominant material trends and prioritise promising A- site cation candidates for further experimental validation and innovation.

Figure 2. Word Clouds

The dashboard is structured into interconnected sections, each designed to serve a distinct purpose. The Homepage overviews key statistics, highlighting top-performing devices, common environmental conditions, and the overall dataset summary. As shown in Figure 3, the homepage of OpenAIPerovskite, users can explore specialised tabs like “Machine Learning,” which enables predictive modelling, or “Graph Visualisation,” which presents high-level data relationships in interactive graphs. Including real-time search and filtering tools ensures that users can quickly locate relevant data and draw meaningful insights.

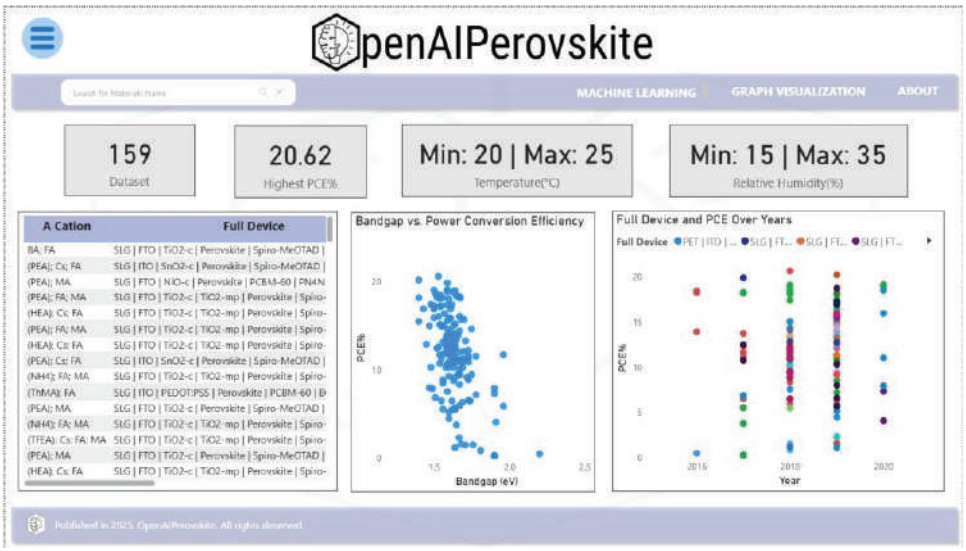

Figure 3. Homepage of OpenAIPerovskite

COMMERCIALISATION

To date, the technology readiness level (TRL) of OpenAIPerovskite is classified as TRL 5, indicating that the system is in the development stage and has been validated in a relevant environment. The platform demonstrates strong potential for future commercialization, with a clear pathway for advancement from TRL 5 to TRL 7.

COMPARISON WITH OTHER PRODUCTS

From a financial perspective, commercial dashboards with integrated analytics and machine learning (ML) capabilities typically cost between RM 80,000 to RM 150,000 (approximately USD 17,000–32,000) in development and licensing fees. Such solutions often require extensive custom coding, dedicated IT infrastructure, and ongoing enterprise software subscriptions. In contrast, OpenAIPerovskite adopts a cost-efficient development approach utilizing Power BI (RM 95 per user/month) and open-source ML environments. The estimated cost to build and deploy the proposed processing, model integration, and hosting. This represents a cost reduction of over 90% compared to conventional market alternatives. Table 1 presents a comparative analysis between OpenAIPerovskite and existing perovskite The comparison focuses on key criteria such as data accessibility, interactivity, machine learning integration, cost efficiency, ease of use, and suitability for nons. technical user

Table 1. Comparison of OpenAIPerovskite with Existing Perovskite Research Platforms

Feature	OpenAIPerovskite	MaterialsZone	PDP	NOMAD
Cost	RM 80,000 to RM 150,000	Commercial dashboards with integrated analytics and ML capabilities typically range from RM 80,000 to RM 150,000 (USD 17,000–32,000)		
Open-access research database	Available	Not Available	Available	Available
Focus on 2D Perovskite	Available	Not Available	Not Available	Not Available
Machine learning integration	Available	Available	Not Available	Available
Natural language processing (NLP)	Available	Not Available	Not Available	Not Available

ACHIEVEMENT

Based on this prototype, the findings were presented at the 8th International Conference on Multi-Disciplinary Research Studies and Education (ICMDRSE-2025), a Scopus-indexed international conference, held on 22nd-23rd May, 2025. Furthermore, two industry partners-Arus EnerG Sdn. Bhd. and Dahan Tech Sdn. Bhd, have expressed interest in the platform, underscoring its potential for real-world application and future commercialization.

REFERENCES

Wang, C., Dong, X., Chen, F., Liu, G., & Zheng, H. (2023). Recent progress of two-dimensional Ruddlesden–Popper perovskites in solar cells. Materials Chemistry Frontiers, 7(22), 5786–5805. https://doi.org/10.1039/d3qm00547j

Zhang, F., Lu, H., Tong, J., Berry, J. J., Beard, M. C., & Zhu, K. (2020). Advances in two-dimensional organic–inorganic hybrid perovskites. Energy & Environmental Science, 13(4), 1154–1186. https://doi.org/10.1039/c9ee03757h

Zhao, X., Liu, T., & Loo, Y.-L. (2021). Advancing 2D Perovskites for Efficient and Stable Solar Cells: Challenges and Opportunities. Advanced Materials, 33(5), 2105849. https://doi.org/10.1002/adma.20210584


i-SPiKE2025