Digital Twin in Agriculture

UPM's Digital Twin Agricultural Monitoring System marks a significant milestone by embracing IR 4.0 principles. This system utilizes precision agriculture for improved food production, aquaculture, and sustainable forest plantation management with a focus on biodiversity. The accomplishment lies in creating and implementing a digital twin approach for farming, enabling real-time monitoring of plant growth and continuous improvement of agricultural ecosystems. The system optimizes factors like water irrigation, air quality, soil conditions, temperature, and humidity while minimizing energy input. It also serves as a proactive measure against potential issues like disease outbreaks and pests, contributing to more sustainable and productive agricultural landscapes in harmony with nature.

Faculty of **Agriculture** University **Community Transformation** Centre Faculty of **Engineering** Faculty of Science Computer and **Information Technology** Faculty of **Forestry** International Institute of **Aquaculture &** Aquatic Science Institute of **Plantation** Studies Institute of **Tropical Forestry** and Forest Products Institute for **Mathematical** Research **Smart Farming** Research Centre Research Management Centre, UPM
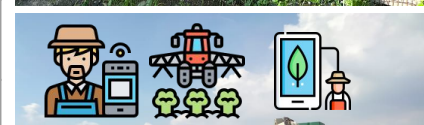
Pekebun MOSTI Strategic Planning, and Kampung Kundur Pedas Negeri Sembilan,

5 Pertubuhan Peladang Kawasan (PPK) Langkawi & Pesawah Tanjung Karang

2 Aquaculture - 10 Families at Temerloh or Pekan, Pahang

2 Plantation managers - Sg Buloh & Kg. Kundur

UNTUK RAKYAT
A SELF-LEARNING ONLINE PROGRAM FOR THE NATION

Official launch by
YAB Dato' Seri Anwar bin Ibrahim
The Right Honourable Prime Minister

9.00 am – 4.00 pm | 16 January 2024
Dewan Besar, Universiti Putra Malaysia (UPM)

MyDIGITAL
MINISTRY OF ECONOMY
intel.

Program	Digital Agricultural Extension Centre
Description	With the aspiration from **Daya Cipta Ekonomi MADANI,** we aim to establish rural and university digital extension centres to accelerate the adaptation of IR 4.0 and precision farming in agricultural innovations (smart agriculture, GIS & GPS for soil scanning and data management, hydroponics, algae raw materials, drone technology, agriculture at sea, and crop diversity for the society.
Entity	Universiti Putra Malaysia
Funder	Industry-University Matching grants
Researchers	Assoc. Prof. Dr. Ts Nurfadhlina Binti Mohd Sharef, Assoc. Prof. Dr. Siva Kumar Balasundram, Assoc. Prof. Dr. Ahmad Fikri Bin Abdullah, Assoc. Prof. Dr. Nazmi Bin Mat Nawi, Assoc. Prof. Dr. Aimrun Wayayok, Assoc. Prof. Dr. Natrah Fatin Bt Mohd Ikhsan, Dr. Ruzana Adibah Binti Mohd Sanusi and Prof. Ir. Ts. Dr Khalina Abdan.
Contact info	khalina@upm.edu.my

Sekinchan Selangor

Official launch by
YAB Dato' Seri Anwar bin Ibrahim
The Right Honourable Prime Minister

9.00 am – 4.00 pm | 16 January 2024
Dewan Besar, Universiti Putra Malaysia (UPM)

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FOR THE NATION

Project Title	MyAgriDT: Digital Twin System for Integrated Multi-Crop Intelligence
Description	MyAgriDT revolutionizes crop management by introducing a Digital Twin prototype that addresses the challenges of optimizing crop growth and yield. Unlike existing works, this system integrates multi-enterprise farm IoT systems and crop growth records into a centralized crop data lake, overcoming challenges related to data consistency and providing a comprehensive understanding of crop dynamics.
Entity	Faculty of Computer Science and Information Technology (FSKTM), UPM
Funder	RMC Geran Strategik UPM, 2022-2024
Researchers	Nurfadhlina Mohd Sharef, Ghodratollah Solimanian, Azreen Azman, Sufry Mohamad, Anahita Ghazvini, Syaifulnizam Abdul Manaf, Hizmawati Madzin, Lee Lai Soon, Choo Wei Chong
Contact info	nurfadhlina@upm.edu.my

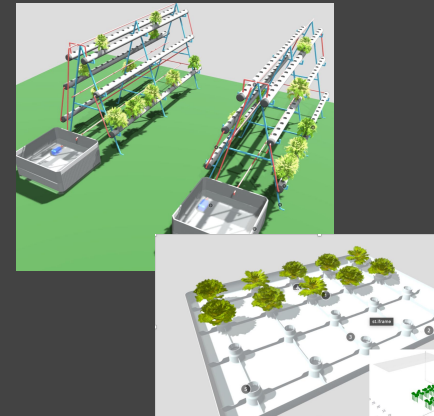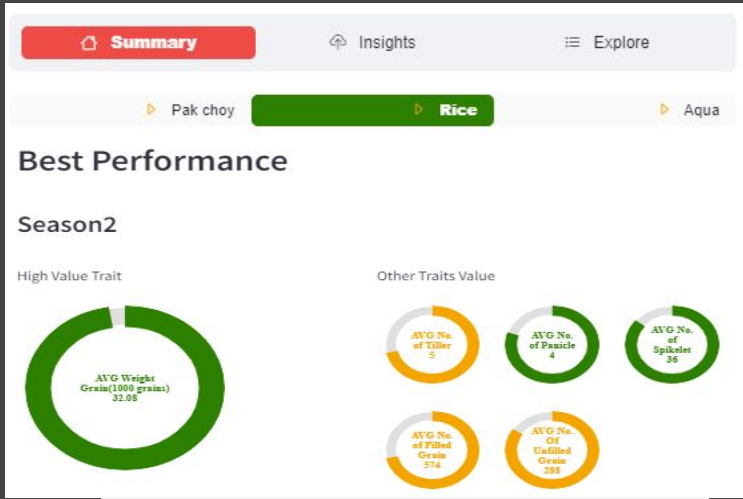# MyAgriDT: Digital Twin System for Integrated Multi-Crop Intelligence

- **Integrates multiple farm IoT systems**
- **Reports crop status and trends**
- **Highlights crops at-risk**
- **Recommend nutrient recovery**

Nurfadhlina Mohd Sharef, Ghodratollah Solimanian, Azreen Azman, Sufry Mohamad, Anahita Ghazvini, Syaifulnizam Abdul Manaf, Hizmawati Madzin, Lee Lai Soon, Choo Wei Chong
nurfadhlina@upm.edu.my

Project Title	Real-Time Grain Loss Monitoring System
Description	The system can monitor the amount of grain loss during harvest in real-time and alert an operator of a combine harvester to adjust the machine settings to be operated at the optimum speed to minimise grain loss
Entity	Faculty of Engineering (FK), UPM
Funder	RMC Geran Strategik UPM, 2022-2024
Researchers	Nazmi Mat Nawi, Bomoi Muhammad Isa, Samsuzana Abd Aziz, Muhammad Saufi Mohd Kassim
Contact info	nazmimat@upm.edu.my

Real-Time Grain Loss Monitoring System

Monitoring screen inside cabin

Cost effective and reliable system

IoT technology for remote monitoring

Laboratory tested

Nazmi Mat Nawi, Bomoi Muhammad Isa, Samsuzana Abd Aziz, Muhammad Saufi Mohd Kassim
nazmimat@upm.edu.my

RMC Geran Strategik UPM, 2022-2024

AI UNTUK RAKYAT
A SELF-LEARNING ONLINE PROGRAM
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Dewan Besar, Universiti Putra Malaysia (UPM)

MyDIGITAL   MINISTRY OF ECONOMY   intel.

Project Title	SMART Pineapple Farm Management
Description	A sensor tower to monitor the plant growth, soil characteristics, weather parameters and pest detection installed at pineapple farm will enable farm manager to retrieve the on-site information via IoT connection. More efficient pineapple farm management can be practiced through the developed SMART pineapple system.
Entity	Faculty of Engineering (FK), UPM
Funder	RMC Geran Strategik UPM, 2022-2024
Researchers	Aimrun Wayayok, Norhashila binti Hashim, Ahmad Fikri bin Abdullah, Tengku Adhwa Shaherah binti Tengku Mohd Suhairi, Qistina Aqilah binti Adbul Rahman
Contact info	aimrun@upm.edu.my

SMART Pineapple Farm Management
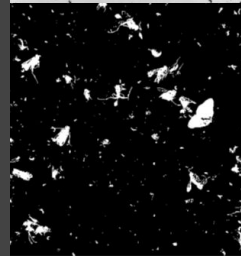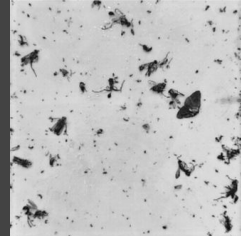

Plant growth monitoring

Soil monitoring

Pest detection and warning

Weather monitoring

Aimrun Wayayok, Norhashila binti Hashim, Ahmad Fikri bin Abdullah, Tengku Adhwa Shaherah binti Tengku Mohd Suhairi, Qistina Aqilah binti Adbul Rahman
aimrun@upm.edu.my

Image analysis using STERL in MATLAB image analysis modul

Project Title	Aquatic Environmental Monitoring in Mangrove Ecosystem via Internet of Things Application
Description	This project is a continuation of MEITA or *'Sustainable Aquatic Resource Management in Mangrove Ecosystem via Internet of Things Application'* project with the mission to connect, empower, and provide awareness to the global community on the importance of mangroves and its ecosystem monitoring through the use of technology. This project involved various academic institutions in the Europe and Asia.
Entity	Faculty of Agriculture, UPM
Funder	Geran Putra IPB, 2022-2024
Researchers	Prof. Madya Dr. Natrah Fatin Mohd Ikhsan, Prof. Ir. Dr. Aduwati Sali, Dr. Annie Christianus, Dr. Evelyn Lim Ai Lin, Prof. Ir. Ts. Dr. 'Athif Mohd Faudzi, Dr. Ahmad Aldrie Amir, Prof. Madya Dr. Yuzine Esa, Dr. Dania Aziz, Dr. Norhariani Mohd Nor, Prof Dr. Muta Harah Zakaria
Contact info	natrah@upm.edu.my

Aquatic Environmental Monitoring in Mangrove Ecosystem via Internet of Things Application
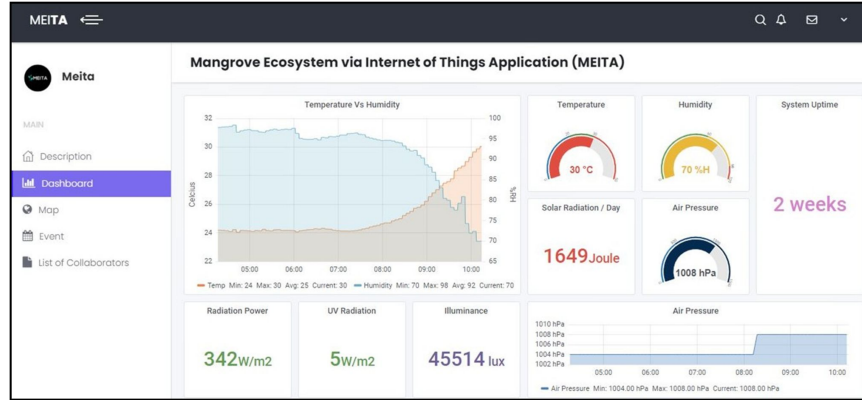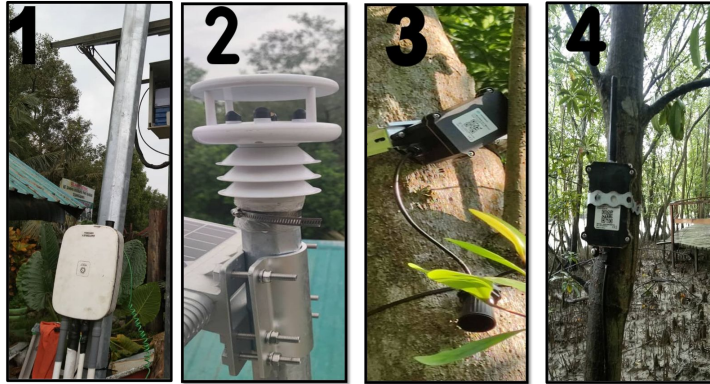
Installed on site:

1) LoRA Gateway, Solar Power System
2) Environmental Sensor
3) Water Level Sensor
4) Soil Temperature & Soil Humidity Sensor

DASHBOARD
VIEW DATA

meita.org.my

Parameters measured
Temperature, Humidity, Solar radiation, UV Radiation, Illuminance, Particulate matter, Precipitation, Air Pressure, Wind speed, Wind direction, Water level, Soil temperature, Soil humidity

Prof. Madya Dr. Natrah Fatin Mohd Ikhsan, Prof. Ir. Dr. Aduwati Sali, Dr. Annie Christianus, Dr. Evelyn Lim Ai Lin, Prof. Ir. Ts. Dr. 'Athif Mohd Faudzi, Dr. Ahmad Aldrie Amir

Project Title	**DEVELOPMENT OF DIGITAL NURSERY MONITORING AND MANAGEMENT OF BAMBOO AND EUCALYPTUS**
Description	The system can monitor the environmental factors such as soil moisture, air temperature and relative humidity as an alert to the nursery managers based on the watering requirement of the selected plants. This system provides support in optimising plant growth in the nursery, consequently contributing to the production of high quality planting materials.
Entity	Institute of Tropical Forestry and Forest Products (INTROP), UPM
Funder	RMC Geran Strategik UPM, 2022-2024
Researchers	Dr. Ruzana Adibah Mohd Sanusi, Dr. Sheriza Mohd Razali, Dr. Syahmi Hishamudin, Prof. Ir. Ts. Dr. Khalina Abdan, Prof. Ir. Dr. Aduwati Sali, Prof. Dr. Hazandy Abd Hamid, Dr. Norfaryanti Kamaruddin, Mohd Hambali Mohd Jailani
Contact info	ruzanasanusi@upm.edu.my

DIGITAL NURSERY MONITORING AND MANAGEMENT OF BAMBOO AND EUCALYPTUS

Nursery digital monitoring for plant management and overall efficiency

- Precise and accurate data on environmental conditions
- Remote Monitoring
- Optimal Growing Conditions
- Optimizing resource usage such as water

B1: Temperature
78.3 F

B2: Relative Humidity
95.7 %

D1: WaterScout SM 100
21.7 %VWC

E1: WaterScout SM 100
18.9 %VWC

Absolute Humidity
22.9 g/m³

Dew Point
76.9 F

VPD
0.14 kPa

Real-time Speconnet Watchdog system

Ruzana Sanusi, Sheriza Razali, Syahri Hishamudin, Khalina Abdan, Aduwati Sali, Hazandy Abd Hamid,. Norfaryanti Kamaruddin, Hambali Jailani

ruzanasanusi@upm.edu.my

Project Title	**Optimization of rice production using precision agriculture and data-driven approaches**
Description	This study delves into leveraging AI methodologies to optimize nutrient application, contributing to enhanced crop productivity and addressing crucial facets of global food security and self sufficiency in rice production.
Entity	Faculty of Agriculture, UPM
Funder	UPM Strategic Grant, 2022-2024
Researcher	Siva K Balasundram
Contact info	siva@upm.edu.my

AI FOR NUTRIENT MANAGEMENT IN RICE

One of the biggest challenge in IR 4.0 is to eradicate hunger, achieve food security, better nutrition and sustainable agriculture

Rice is the major staple food of Asia, and an important source of employment and income in rural areas, particularly in low-income countries

This study delves into leveraging AI methodologies to optimize nutrient application, contributing to enhanced crop productivity and addressing crucial facets of global food security and self-sufficiency in rice production

➤ Study site: IADA Seberang Perak, Kampung Gajah, Perak, Malaysia
➤ Study duration: 3 planting seasons (1st & 3rd dry season, 2nd wet season)
➤ Data collected from the field:

Days After Sowing	Soil	Plant	SPAD	Spectral (nm)
0	C, pH, N, P, K, Ca, Mg, CEC	-	-	-
30	C, pH, N, K	N, P, K, Ca, Mg	Leaf	-
45	-		Leaf	350 - 2500
60	C, pH, N, K	N, P, K, Ca, Mg	Leaf	-
90	C, pH, N, P, K, Ca, Mg, CEC	N, P, K, Ca, Mg	Leaf	350 - 2500

KEY FINDINGS:

1. Variations in C:N and K:N directly impacts yield

2. Gradient Boost Machine appears to be more stable across different seasons and time points

3. C:N exhibits a better significance in seasons 1 and 3 than in season 2. But with K:N, the significance is gradually increasing across seasons.

Siva K Balasundram | siva@upm.edu.my
UPM Strategic Grant, 2022-2024

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The Right Honourable Prime Minister

9.00 am – 4.00 pm | 16 January 2024
Dewan Besar, Universiti Putra Malaysia (UPM)

MyDIGITAL   MINISTRY OF ECONOMY   intel.

Project Title	RiceRescue: An AI-Enhanced Multimodal System for Paddy Health Status Monitoring and Pests Detection
Description	This project is centered on the detection of diverse diseases affecting paddy crops, as well as signaling nutrient deficiencies in the plant. Through multimodalities (image and sound), the system is able to capture and identify various classes of paddy diseases (e.g. Bacterial Leaf Blight, Brown Spot, Leaf Smut, and Bacterial Pinnacle Blight), paddy pests (e.g. Rice Gall Midge, Rice Leaf Caterpillar, Rice Leaf Roller, Rice Leaf Hopper, Rice Shell Pest, and Rice Water Weevil), as well through the sounds of pests, e.g. Cicadas, Mice, Frogs, Birds, and Snakes. Additionally, the project leverages IoT technology to incorporate sound detection of pests, providing real-time information through a mobile application synchronized with the IoT's GPS.
Entity	Faculty of Computer Science and Information Technology (FSKTM), UPM
Funder	N/A
Researchers	Noris Mohd Norowi, Nuur Alifah Roslan, Haziq Hakimi Mazlisham, Haris Azhari Zainudin, Muhammad Hakim Zulkhainain, Teo Rhun Ming
Contact info	noris@upm.edu.my

RiceRescue: An AI-Enhanced Multimodal System for Paddy Health Status Monitoring and Pests Detection

This project is centered on the detection of diverse diseases affecting paddy crops, as well as signaling nutrient deficiencies in the plant. Through multimodalities (image and sound), the system is able to capture and identify various classes of paddy diseases (e.g. Bacterial Leaf Blight, Brown Spot, Leaf Smut, and Bacterial Pinnacle Blight), paddy pests (e.g. Rice Gall Midge, Rice Leaf Caterpillar, Rice Leaf Roller, Rice Leaf Hopper, Rice Shell Pest, and Rice Water Weevil), as well through the sounds of pests, e.g. Cicadas, Mice, Frogs, Birds, and Snakes. Additionally, the project leverages IoT technology to incorporate sound detection of pests, providing real-time information through a mobile application synchronized with the IoT's GPS.
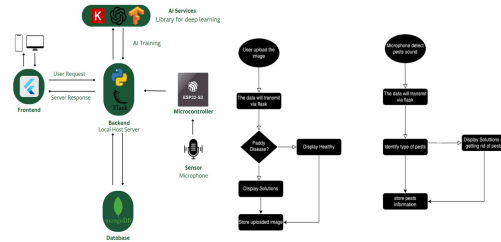

Figure 1. Paddy diseases and pests

Plant Health Analysis   Pests Detection   GPS

Figure 1. Proposed Solutions

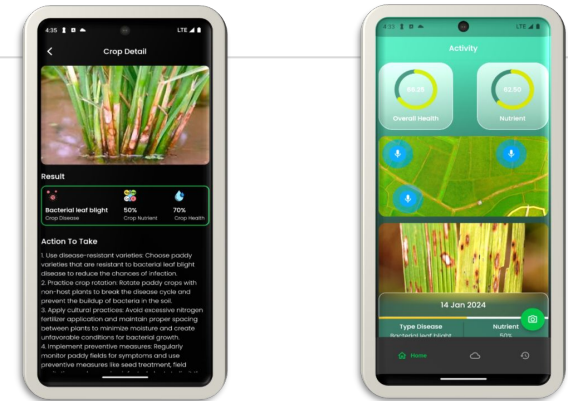Figure 3. Rice Rescue Architecture

Figure 4. Rice Rescue Applications

PROJECT MEMBERS

HAZIQ HAKIMI MAZLISHAM
Bac. of Computer Sc.
(Multimedia Computing)

HARIS AZHARI ZAHARUDIN
Bac. of Computer Sc.
(Multimedia Computing)

M. HAKIM ZULKHAINAIN
Bac. of Computer Sc.
(Multimedia Computing)

TEO RHUN MING
Ph.D. in Human-Computer Interaction

DR. NORIS MOHD. NOROWI
Senior Lecturer
Multimedia Department

DR. NUUR ALIFAH ROSLAN
Senior Lecturer
Multimedia Department

FACULTY OF COMPUTER SCIENCE AND INFORMATION TECHNOLOGY, UNIVERSITI PUTRA MALAYSIA, 43400, SERDANG, SELANGOR

Official launch by
YAB Dato' Seri Anwar bin Ibrahim
The Right Honourable Prime Minister

9.00 am – 4.00 pm | 16 January 2024
Dewan Besar, Universiti Putra Malaysia (UPM)

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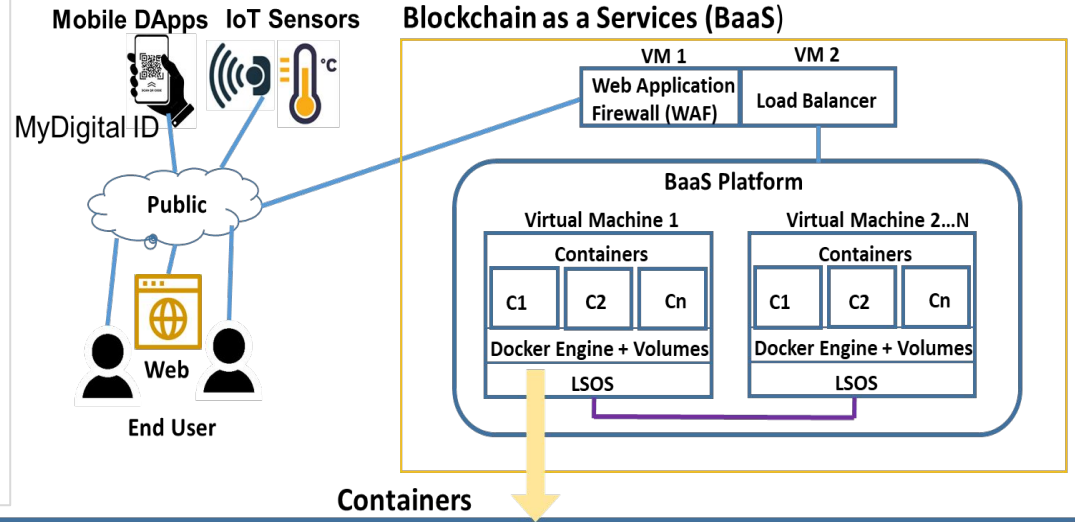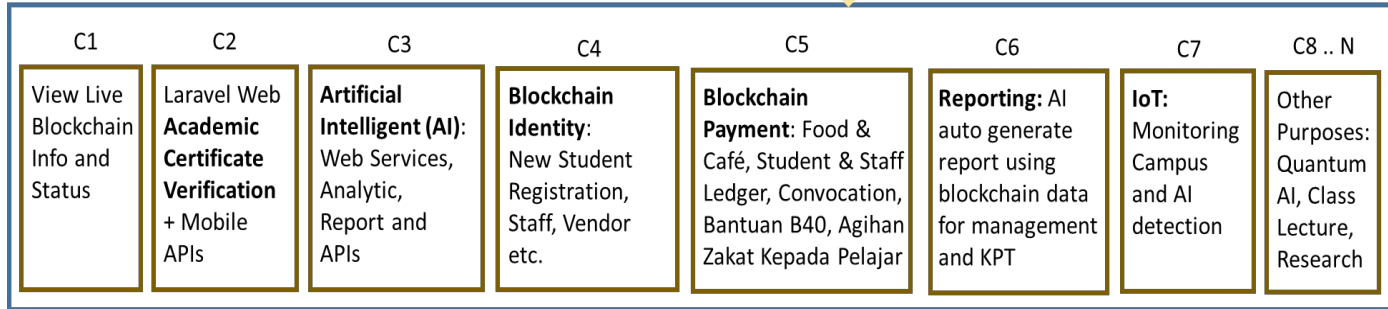| Project Title	Smart IoT Monitoring using AI within Blockchain Technology
Description	Smart IoT Monitoring using AI is a decentralized blockchain platform using a peer-to-peer network that securely executes and verifies application code within the Hyperledger Fabric platform. Each user can use Blockchain identity integrated with Malaysian's MyDigital ID to access and perform daily tasks seamlessly using Blockchain as a Services (BaaS) hosted in secure Docker Containers.
Entity	Faculty of Computer Science and Information Technology (FSKTM), UPM
Funder	N/A
Researchers	Prof. Dr. Zuriati Ahmad Zukarnain (Principal Researcher, UPM), Prof. Dr. Ramlan Mahmod (UPM) and Ts. Dr² Mohd Anuar Mat Isa, Alumni UPM (Developer, iExploTech Sdn Bhd,)
Contact info	zuriati@upm.edu.my

Smart IoT Monitoring using AI within Blockchain Technology

Smart IoT Monitoring using AI is a decentralized blockchain platform using a peer-to-peer network that securely executes and verifies application code within the Hyperledger Fabric platform. Each user can use Blockchain identity integrated with Malaysian's MyDigital ID to access and perform daily tasks seamlessly using Blockchain as a Services (BaaS) hosted in secure Docker Containers.

Mobile DApps   **IoT Sensors**

MyDigital ID

Public

Web

End User

Blockchain as a Services (BaaS)

VM 1   VM 2

Web Application Firewall (WAF)   Load Balancer

BaaS Platform

Virtual Machine 1

Containers

C1   C2   Cn

Docker Engine + Volumes

LSOS

Virtual Machine 2...N

Containers

C1   C2   Cn

Docker Engine + Volumes

LSOS

Containers

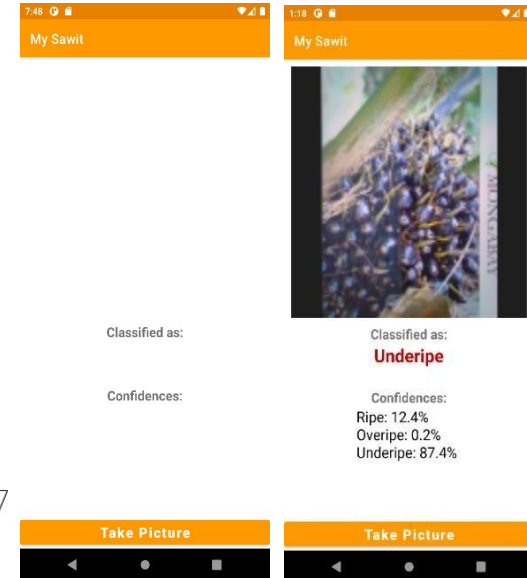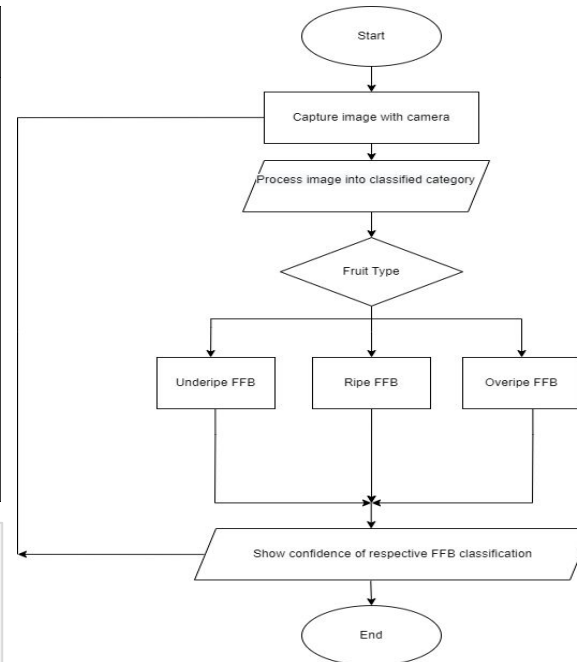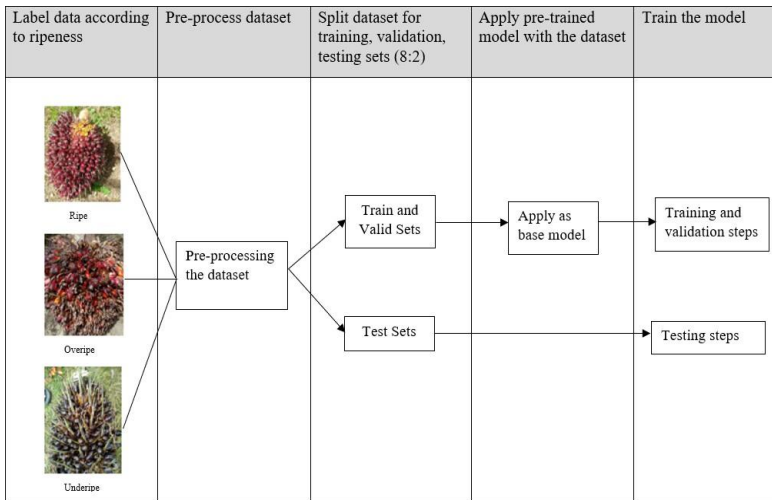| C1	C2	C3	C4	C5	C6	C7	C8 .. N
View Live Blockchain Info and Status	Laravel Web **Academic Certificate Verification** + Mobile APIs	**Artificial Intelligent (AI)**: Web Services, Analytic, Report and APIs	**Blockchain Identity**: New Student Registration, Staff, Vendor etc.	**Blockchain Payment**: Food & Café, Student & Staff Ledger, Convocation, Bantuan B40, Agihan Zakat Kepada Pelajar	**Reporting**: AI auto generate report using blockchain data for management and KPT	**IoT**: Monitoring Campus and AI detection	Other Purposes: Quantum AI, Class Lecture, Research

Team Members:
1. Prof. Dr. Zuriati Ahmad Zukarnain (Principal Researcher, UPM)
2. Prof. Dr. Ramlan Mahmod (UPM)
3. Ts. Dr² Mohd Anuar Mat Isa, Alumni UPM (Developer, iExploTech Sdn Bhd,)

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iExplo Tech
www.iexplotech.com

Project Title	**Monitoring Oil Palm Fresh Fruit Bunches (FFB) for Effective Harvest**
Description	The palm oil industry is a well-known source of income, particularly in Malaysia. Monitoring and classifying oil palm fresh fruit bunches represent a challenging and tedious task. The application is designed to assist smallholders in monitoring fruit bunch maturity and classifying them into three categories: underripe, ripe, and overripe, aiming to enhance effective harvesting and prevent harvest wastage.
Entity	Faculty of Computer Science and Information Technology (FSKTM), UPM
Funder	-
Researchers	Abdullah Muhammed, Nur Amirah Zhafira Binti Zulkfli @ Zulkifli
Contact info	abdullah@upm.edu.my

MONITORING OIL PALM FRESH FRUIT BUNCHES (FFB) FOR EFFECTIVE HARVEST

Assessing the maturity of oil palm fresh fruit bunches (FFB) manually is a tedious and challenging task; and classifying them into their respective categories is crucial. Small-scale palm oil farm owners often face the risk of being deceived by their workers due to limited knowledge in determining these categories. Therefore, the project aims to develop a mobile application utilizing a machine learning model for assessing the maturity of oil palm fresh fruit bunches (FFB). With this portable application, owners can enhance their monitoring efficiency by simply capturing images of the oil palm fresh fruit bunches. This approach allows owners to exert better control over the quality of fresh fruit bunches produced on their farms.
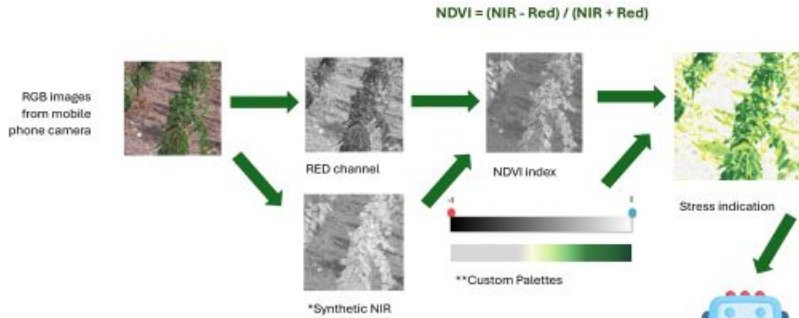
Abdullah Muhammed, Nur Amirah Zhafira binti Zulkfli @ Zulkifli
abdullah@upm.edu.my

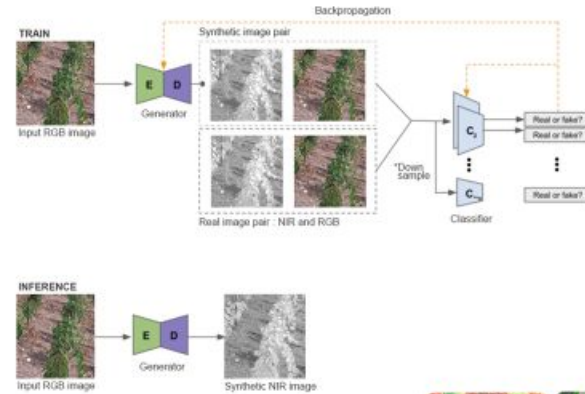| Project Title	**Stress Detection in Plants with DEEP-NDVI Formulation**
Description	Most agricultural vegetation assessments employ the Normalised Difference Vegetation Index (NDVI). Divide the visible and near infrared spectral areas to get the value. However, NDVI computation needs costly hyperspectral and multispectral optical instruments. Deep-NDVI is an AI model that extracts NDVI from mobile phone RGB images. This Deep-NDVI model can predict biomass, crop health, agricultural productivity, and more. In this study, the Deep-NDVI model is employed to identify and assess plant stress. The Deep-NDVI model for stress plant detection uses a conditional generative adversarial network (CGAN) to generate Near Infrared (NIR) images, NDVI calculation, custom palettes to visualise the index, and NLP to present results and recommendations.
Entity	Faculty of Computer Science and Information Technology (FSKTM), UPM
Funder	Ministry of Higher Education, Malaysia
Researchers	Puteri Suhaiza Sulaiman, Zainal Abdul Kahar
Contact info	psuhaiza@upm.edu.my

Stress Detection in Plants with DEEP-NDVI Model

Project Title	**Ecological Simulator for Precision Biodiversity**
Description	Ecology simulator can support precision biodiversity initiatives by providing a controlled and customizable environment to explore ecological concepts, test hypotheses, and predict outcomes related to biodiversity. Our solution is based on 1) Data Integration: Gather and integrate biodiversity data from various sources to create a comprehensive and precise digital biodiversity model. 2) Data Analysis: Descriptive analytics to provide insightful visuals for a clearer understanding of biodiversity patterns and changes, and develop prediction algorithms based on historical data, environmental factors, and species interactions. 3) Interactive Simulations: Incorporate interactive simulations that allow users to experiment with different conservation plans and observe the potential outcomes.
Entity	Faculty of Computer Science and Information Technology (FSKTM), UPM
Funder	Rancangan Malaysia ke-12
Researchers	Nurfadhlina Mohd Sharef, Mohd Hafeez Osman, Raihani Mohamed, Nurul Amelina Nasharuddin, Syaifulnizam Abd Manaf, Razali Yaakob, Nabila Wardah Zamani, Niloofar Bozorgvar
Contact info	nurfadhlina@upm.edu.my

Ecological Simulator for Precision Biodiversity

In-growth

7%

55% Small tree

38% Exploitable

Top10 Flora Species Undergrowth

SARADE
DACRR1 — 43
MACALO — 32
XANTEU
SHORM1 — 29
SHORM2
HOPEME — 24
PORTAN
DIPTC1 — 21
MONOMA
RYPAKU

Conservation Prescription

RISK

Exploitable: Harvest 100 trees, 56 species
In growth: Harvest 43 trees, 18 species
Small Tree: Harvest 25 trees, 5 species
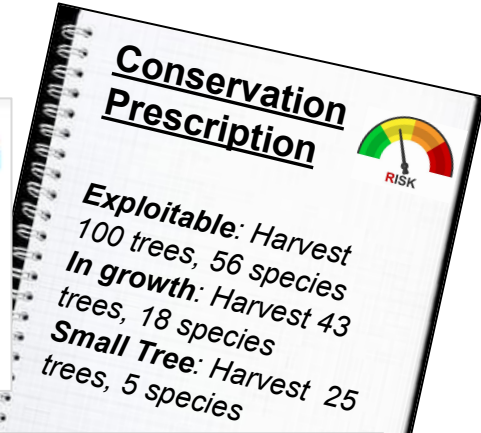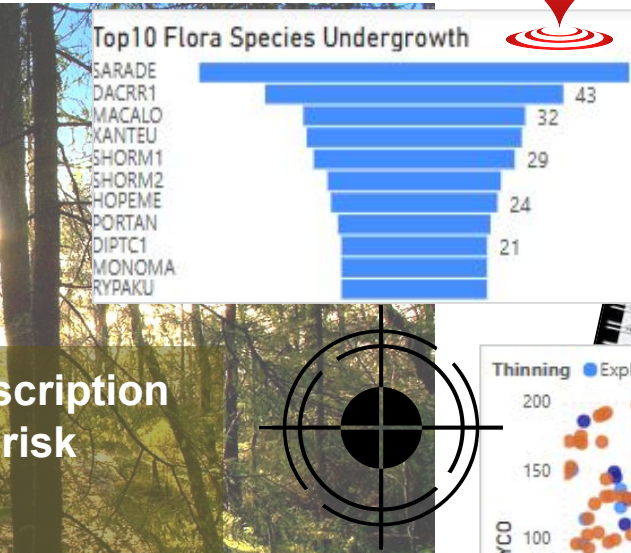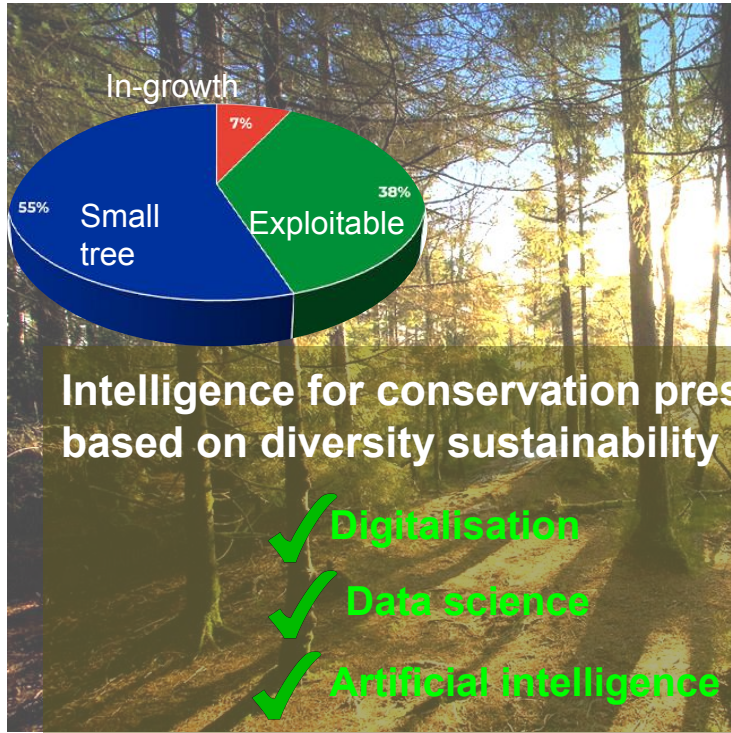
Intelligence for conservation prescription based on diversity sustainability risk

✓ **Digitalisation**

✓ **Data science**

✓ **Artificial intelligence**

Thinning ● Exploitable ● Ingrowth ● Small trees

YCO

200
150
100
50
0
0   20   40   60
XCO

Forecast in 2021 If Felling in 2019

Count of Tree

1,500

1,000

2012   2014   2016   2018   2020
Year

Nurfadhlina Mohd Sharef, Mohd Hafeez Osman, Raihani Mohamed, Nurul Amelina Nasharuddin, Syaifulnizam Abd Manaf, Razali Yaakob, Nabila Wardah Zamani, Niloofar Bozorgvar
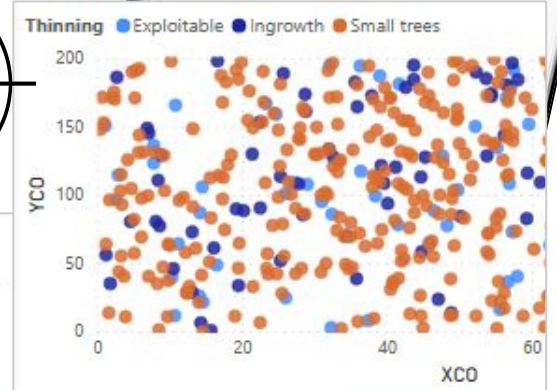Akademi Sains Malaysia
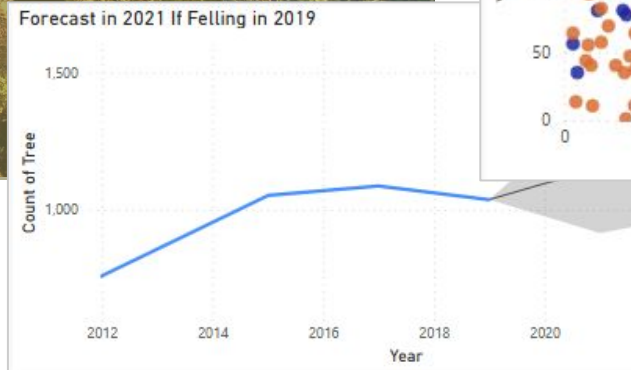nurfadhlina@upm.edu.my
2022-2025

AKADEMI SAINS MALAYSIA

UPM

UNIVERSITI TEKNOLOGI MALAYSIA · KERANA TUHAN UNTUK MANUSIA

Project Title	Cognitive Impairment Progression Prediction Tool
Description	We provide self-screening tool for MMSE progression prediction with XGBoost and a combination of demographic factors (e.g., education level, age), psychosocial assessments (e.g., GDS15), and neuropsychiatric evaluations (e.g., RAVLT and digit span). The inclusion of established neuropsychiatric assessments, such as RAVLT and digit span, strengthens the credibility of the predictive model's features, offering standardized measures of memory and working memory. This nuanced understanding enhances the accuracy of predictions by acknowledging the influence of life experiences, aging, and the interplay of variables like education level and age.
Entity	Malaysia Institute of Ageing Research (MyAgeing)
Funder	United States Air Force Office of Scientific Research
Researchers	Nurfadhlina Mohd Sharef, Anahita Ghazvini, Razali Yaakob, Norwati Mustapha, Khairul Azhar Kasmiran, Lee Lai Soon, Raja Kamil Raja Ahmad
Contact info	nurfadhlina@upm.edu.my

Cognitive Impairment Progression Prediction Tool

Do you know your risk of cognitive impairment like dementia?

We provide a self-screening tool for cognitive impairment progression

Prediction using machine learning with:
- **demographic factors**
- **psychosocial assessments**
- **neuropsychiatric evaluations**

Nurfadhlina Mohd Sharef, Afiqah Anum Yusof, Fakhrul Zaman Rokhani, Mohamad Fazdillah Bagat

nurfadhlina@upm.edu.my

2022-2024

UNTUK RAKYAT
A SELF-LEARNING ONLINE PROGRAM FOR THE NATION

Official launch by
YAB Dato' Seri Anwar bin Ibrahim
The Right Honourable Prime Minister

9.00 am – 4.00 pm | 16 January 2024
Dewan Besar, Universiti Putra Malaysia (UPM)

MyDIGITAL
MINISTRY OF ECONOMY
intel.

Project Title	AIPerLA: Augmented Intelligence for Personalized Learning Advisory
Description	AIPerLA is a software package for augmenting educators and students while facilitating personalized learning implementation. The purpose is to allow students to have a personalized learning plan through their history of interactions with the student information system and learning management system, and for the instructors to get a recommendation of teaching intervention to ensure a quality teaching delivery and curriculum. AIPerLA consists of five prototypes namely ISPerL, CLADS, STILA, AcaPerforma and VLearnAI.
Entity	Faculty of Computer Science and Information Technology (FSKTM), UPM
Funder	-
Researchers	Nurfadhlina Mohd Sharef, Nurul Amelina Nasharuddin, Fakhrul Zamani Rokhani, Masrah Azrifah Azmi Murad, Azreen Azman
Contact info	nurfadhlina@upm.edu.my

AIPerLA:
Augmented Intelligence for Personalized Learning Advisory

Educator
- Monitor students performance and engagement
- Review students growth and gaps
- Predict students at-risk
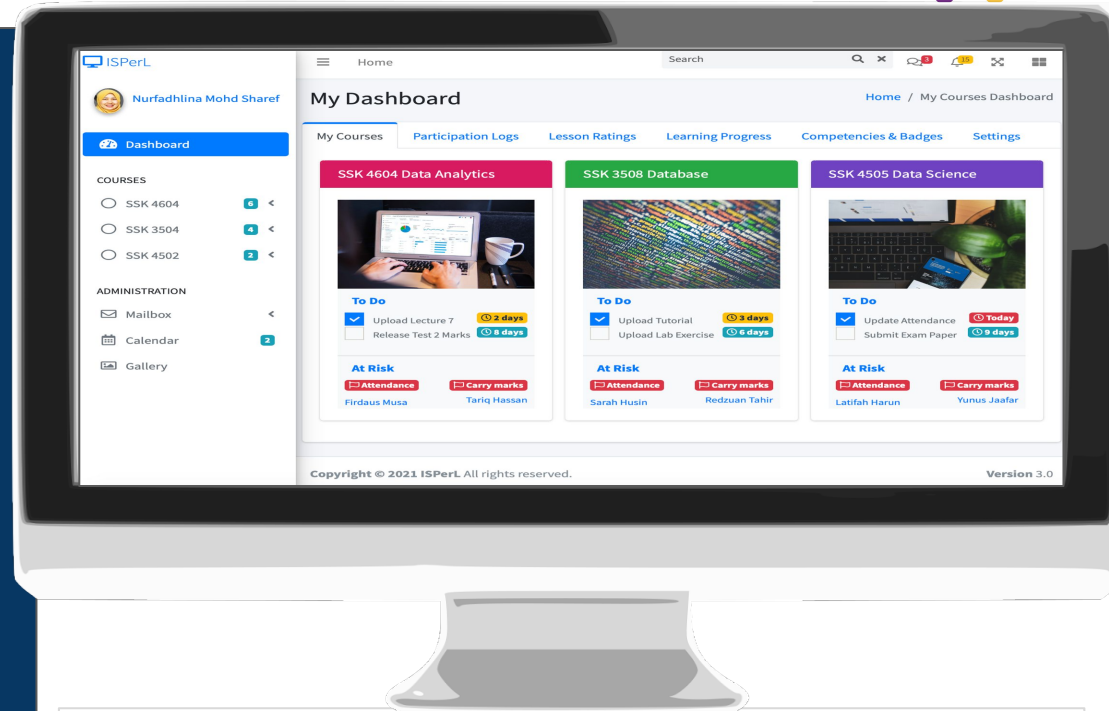- Customise recommended students learning plan

Students
- Review self progress and achievement
- Get performance prediction
- Get recommendation of learning plans and materials

Academic administrator
- Analyze course performance
- Identify students gaps
- Review and customize machine learning model

AIPerLA
AI-based Personalized Learning Advisor

Nurfadhlina Mohd Sharef, Nurul Amelina Nasharuddin, Fakhrul Zaman Rokhani, Evi Indriasari Mansor, Azreen Azman, Masrah Azrifah Azmi Murad, Muhd Khaizer Omar
nurfadhlina@upm.edu.my

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MyDIGITAL   MINISTRY OF ECONOMY   intel.

Project Title	**AcaPerforma: Interactive Machine Learning-based Early Course Grade Prediction System**
Description	Early student grade prediction in education is crucial for timely intervention. AcaPerforma is developed using a novel MSECosine-based Long Short Term Memory model with Generative Adversarial Network which utilises various feature combinations comprising of demography, learning traces, and assessment. The interactive machine learning approach ensures model explainability, transparency and bias mitigation to ensure responsible artificial intelligence governance.
Entity	Faculty of Computer Science and Information Technology (FSKTM), UPM
Funder	United States Air Force Office of Scientific Research
Researchers	Nurfadhlina Mohd Sharef, Anahita Ghazvini, Razali Yaakob, Norwati Mustapha, Khairul Azhar Kasmiran, Lee Lai Soon, Raja Kamil Raja Ahmad
Contact info	nurfadhlina@upm.edu.my

AcaPerforma: Interactive Machine Learning-based Early Course Grade Prediction System

- **Deep time series grade prediction**

- **Using demography, learning activities and assessments**

- **For personalised learning interventions**

- **Adaptive machine learning approach through human in the loop**

Feature Importance

No	Feature	Total Importance
1	COURSE_ANALYSIS_AND_DESIGN_OF_COMPUTER_GAMES	0.4373
2	COURSE_VIRTUAL_REALITY	0.3433
3	COURSE_WEB_APPLICATION_DEVELOPMENT	0.3413
4	COUNTRY	0.3390
5	COURSE_PROGRAMMING_IN_C++	0.2631
6	GENDER	0.0

APPLY

SRS IML for AcaPerforma

Select Main Menu
Investigation

Select Investigation Option
Feature Importance

Re-Development Options

Select reason for Re-Development:
- [ ] Improve Accuracy
- [ ] Feature Importance (FI)
- [ ] SHAP

Proceed
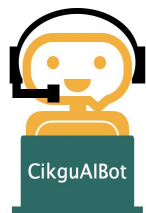
Nurfadhlina Mohd Sharef, Anahita Ghazvini, Razali Yaakob, Norwati Mustapha, Khairul Azhar Kasmiran, Lee Lai Soon, Raja Kamil Raja Mustafa nurfadhlina@upm.edu.my

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AI UNTUK RAKYAT
A SELF-LEARNING ONLINE PROGRAM
FOR THE NATION

Project Title	CikguAIBot: A Malay Chatbot for self AI learning
Description	CikguAIBot is a chatbot developed using Google Dialogflow that focuses on learning experience and encompasses instructional design approaches by offering content (8 topics for concepts, and 10 algorithms information), activities (such as reflection and extra reference), and assessments(8 multi-choice quizzes). It has built-in natural language processing features and is integrated into the Telegram platform. Machine learning, data mining, data science, natural language processing, image recognition, software agents, intelligent search, and evolutionary computing are some of the AI principles that are discussed. Naive Bayes, Decision Tree, Regression, Neural Network, Support Vector Machine, Random Forest, Gradient Descent, K-Means, k-Nearest Neighbout, and Apriori are among the ten algorithms presented.
Entity	Faculty of Computer Science and Information Technology (FSKTM), UPM
Funder	Ministry of Higher Education, Malaysia
Researchers	Nurfadhlina Mohd Sharef, Nurul Amelina Nasharuddin, Evi Indriasari Mansor, Masrah Azrifah Azmi Murad, Khaizer Omar, Normalia Samian, Faaizah Shabodin, Noreen Izza Arshad
Contact info	nurfadhlina@upm.edu.my

CikguAIBot: A Malay Chatbot for self AI learning

Hi!
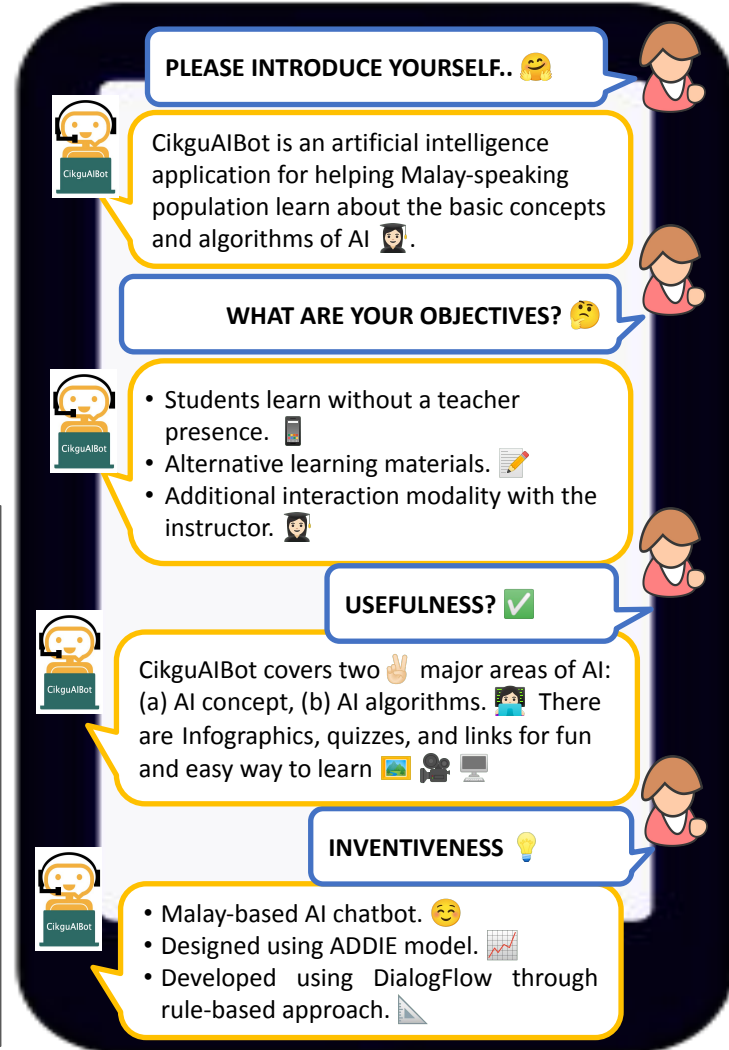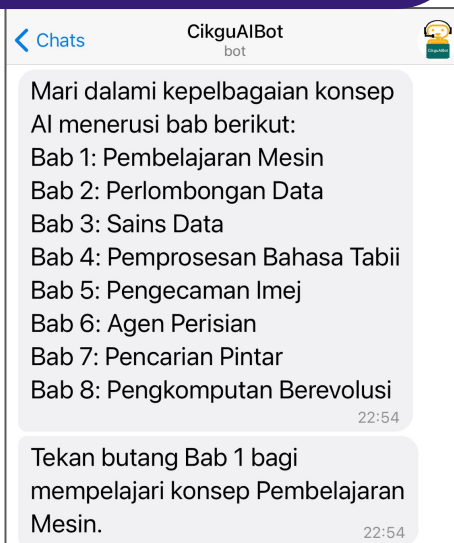CikguAIBot is a Telegram-based chatbot that converse in Malay to teach AI.

Students can interact, navigate the topics, and answer quizzes.

CikguAIBot is developed using Google DialogFlow.

Nurfadhlina Mohd Sharef, Nurul Amelina Nasharuddin, Evi Indriasari Mansor, Masrah Azrifah Azmi Murad, Khaizer Omar, Normalia Samian, Faaizah Shabodin, Noreen Izza Arshad

nurfadhlina@upm.edu.my

Chats — CikguAIBot bot

Mari dalami kepelbagaian konsep AI menerusi bab berikut:
Bab 1: Pembelajaran Mesin
Bab 2: Perlombongan Data
Bab 3: Sains Data
Bab 4: Pemprosesan Bahasa Tabii
Bab 5: Pengecaman Imej
Bab 6: Agen Perisian
Bab 7: Pencarian Pintar
Bab 8: Pengkomputan Berevolusi
22:54

Tekan butang Bab 1 bagi mempelajari konsep Pembelajaran Mesin.
22:54

PLEASE INTRODUCE YOURSELF.. 🤗

CikguAIBot is an artificial intelligence application for helping Malay-speaking population learn about the basic concepts and algorithms of AI 👩.

WHAT ARE YOUR OBJECTIVES? 🤔

- Students learn without a teacher presence. 📱
- Alternative learning materials. 📝
- Additional interaction modality with the instructor. 👩

USEFULNESS? ✅

CikguAIBot covers two ✌️ major areas of AI: (a) AI concept, (b) AI algorithms. 👨‍💻 There are Infographics, quizzes, and links for fun and easy way to learn 🖼️ 🎥 🖥️

INVENTIVENESS 💡

- Malay-based AI chatbot. 😊
- Designed using ADDIE model. 📈
- Developed using DialogFlow through rule-based approach. 📐

Project Title	AI4Edu Micro-credentials Program
Description	The "AI4Edu Micro-credentials Program" is a comprehensive educational initiative comprising three courses: "AI for Society in 100 Minutes," "AI for Educator," and "Chatbot for Learning with DialogFlow ES." The program aims to empower educators and professionals with essential knowledge and skills in the field of artificial intelligence (AI) to effectively integrate these technologies into educational settings. The courses cover a range of topics, from the broader societal impact of AI to specialized skills in creating chatbots for enhanced learning experiences using DialogFlow ES. By providing participants with practical insights and hands-on experience, the AI4Edu Micro-credentials Program equips them with the expertise needed to navigate the evolving landscape of AI in education.
Entity	Faculty of Computer Science and Information Technology (FSKTM), UPM
Funder	Ministry of Higher Education, Malaysia
Researchers	Nurfadhlina Mohd Sharef, Nurul Amelina Nasharuddin
Contact info	nurfadhlina@upm.edu.my

AI4Edu Micro-credentials Program

The "AI4Edu Micro-credentials Program" is an open education initiative comprising three courses: "AI for Society in 100 Minutes," "AI for Educator," and "Chatbot for Learning with DialogFlow ES."

The program **aims to empower educators and professionals with essential knowledge and skills in the field of artificial intelligence (AI) to effectively integrate these technologies into educational settings.**

Nurfadhlina Mohd Sharef, Nurul Amelina Nasharuddin
nurfadhlina@upm.edu.my
2022-2023

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Project Title	IEEE CASS Microlearning (CASS MiLe) platform
Description	CASS Microlearning (CASS MiLe) is dedicated to empowering and equipping IEEE members and lifelong learners with an engaging and satisfying educational experience through the provision of competency-based microlearning on an e-learning platform. Artificial Intelligence is one of the competencies provided under the umbrella of CASS MiLe.
Entity	Faculty of Engineering, UPM
Funder	IEEE Circuit and Signal System Society
Researchers	Fakhrul Zaman Rokhani, Nurfadhlina Mohd Sharef, Ahmad Salahuddin Harithuddin, Ain Kamsani, Lee Lini
Contact info	fzr@upm.edu.my

IEEE CASS Microlearning (CASS MiLe) platform

CASS Microlearning (CASS MiLe) is an online learning platform powered by IEEE Circuit and Signal System Society. The platform is founded by Malaysians, and now have students from more than 153 countries since its establishment in 2021.

Artificial Intelligence is one of the competencies provided under the umbrella of CASS MiLe. The platform is equipped with intelligence to monitor courses participation for personalized student progress intervention.

| 30 courses | 1878 users | 153 countries | 399 certificates awarded |

Machine Learning Systems: Low-Energy VLSI Architectures and Applications

AI/ML

On-Chip Epilepsy Detection: Where Machine Learning Meets Wearable, Patient-Specific Wearable Healthcare

AI/ML

Machine Learning and Optimization for Communications and Deep Networks

AI/ML

Machine Learning for Analytics Architecture: AI to Design AI

AI/ML

Machine Learning in Agrifood – Series 1

AI/ML

Machine Learning in Agrifood – Series 2

AI/ML

Fakhrul Zaman Rokhani, Nurfadhlina Mohd Sharef, Ahmad Salahuddin Harithuddin, Ain Kamsani, Lee Lini
fzr@upm.edu.my
IEEE Circuit and Signal System Society, since 2021

CAS MiCRO LEarning

Project Title	GLU@U: Smart and Integrated Digital Healthcare SaaS Platform for Real-Time Glucose Monitoring
Description	GLU@U is a smart and integrated real-time glucose monitoring system enable by artificial intelligence (AI) which provide data support and decision-making basis in preventing and controlling diabetes and its complications. It offers consistent, thorough and reliable blood glucose information throughout the day that may provide a smart healthy living environment for everyone.
Entity	Faculty of Design and Architecture, Universiti Putra Malaysia
Funder	-
Researchers	Mohd Johari Mohd Yusof; Jiao Fenglei; Shureen Faris Abd Shukor; Nor Zalina Harun
Contact info	m_johari@upm.edu.my

GLU@U
Smart and Integrated Digital Healthcare SaaS Platform for Real-Time Glucose Monitoring

The prevalence of diabetes is still rising globally as a result of changes in lifestyle. According to statistics, the prevalence rate of diabetes was 8.8% in 2017, affecting over 415 million individuals worldwide between the ages of 20 and 79. The annual treatment cost for a single patient is significantly lower than that of developed nations, despite the fact that the awareness cure rate and management compliance rate are relatively low. A lack of medical resources, uncooperative patients, and inaccurate monitoring and treatment are the main causes. **Continuous glucose monitoring (CGM) is a monitoring technique** that measures the concentration of glucose in the subcutaneous interstitial fluid **using glucose sensors** to reflect the blood glucose level. **It can offer consistent, thorough, and reliable blood glucose information throughout the day,** assist in creating individualized, exact treatment regimens, offer visual tools for diabetes education, and enhance patient compliance and the efficiency of overall care. In order to serve the population with diabetes and its complications, the purpose of this innovation is **to construct a set of multi-modal monitoring and digital diagnosis** and treatment management mode **driven by CGM and enabled by AI**. GLU@U would be able **to provide data support and decision-making basis** in preventing and controlling diabetes and its complications, and obviously, this data-driven and algorithm-based solution may provide a smart healthy living environment for everyone.

Mohd Johari Mohd Yusof | Jiao Fenglei | Shureen Faris Abd Shukor | Nor Zalina Harun
FRSB, UPM

GLU@U

Malaysia's first digital healthcare SaaS platform for continuous glucose monitoring for active health

Smart CGM hardware

Continuous glucose monitoring, real-time transferable blood glucose data collection device + Iots Blood Glucose Meter + Smart real-time ECG/blood pressure/cardiogram

SaaS data platform + digital therapy

In-hospital + out-of-hospital + at-home multi-scene convergence of big data
AI Active Health core algorithms (intelligent alerting, trend prediction, risk prediction, clinical assisted diagnosis)

Online doctors | Medical Care Services

Data + Digital Therapy + Hardware + Services

*Digital therapy products for research and translation of

The System Components

Emitter	Sensor	Needle aid	Separator	FPD+bracket	Healthwell APP	Glu@U® CGM system
Transmitted signal non-consumable reusable	Collecting interstitial fluid for analysis	Put sensors and transmitters under the skin	Separate the emitter from the sensor	Data recording Data analysis Intelligent AI	Data recording Data analysis Intelligent AI	Unified management of patients with abnormal blood glucose inside and outside the hospital

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UNTUK RAKYAT
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FOR THE NATION

MyDIGITAL
MINISTRY OF ECONOMY
intel.

Project Title	Social AI: Advancing Inclusive & Diverse Communication for All
Description	Social AI is dedicated to creating inclusive & diverse communication tools for the people (rakyat) of Malaysia, with a focus on enhancing accessibility for individuals with disabilities. It able to recognize both speech and hand sign gestures to be translated into text-based speech so that the AI powered Large Language Model could help to answer any queries. The technology combines image detection (face & hand gesture), speech detection, and generative AI model.
Entity	Faculty of Science (FS), UPM
Funder	-
Researchers	Mohd Amiruddin Abd Rahman, Caceja Elyca Anak Bundak, Nurin Syazwina Mohd Haniff, Nur Athirah Mohd Shazali, Siti Fairuz Mat Radzi, Athiyyah Qistina Abdul Hakim, Lokman Hakim Muhamad, Muhammad 'Aqil Syahiran Izham, Badrul Munir Mustafa Kamal
Contact info	mohdamir@upm.edu.my

Social AI: Advancing Inclusive & Diverse Communication for All

Social AI is dedicated to creating inclusive communication tools for the people (rakyat) of Malaysia, with a focus on **enhancing accessibility for individuals with disabilities**. The initiative employs various AI-powered technologies to improve communication interactions within the nation. The project integrates specific AI technologies tailored to the community's needs, including face detection technology for seamless visual engagement. Natural language processing (NLP) is utilized to facilitate smooth speech recognition, enabling effortless conversations with an **AI voice chatbot (Sembangbot)**. The project also emphasizes the integration of **sign language recognition (OKU AI)**, catering to individuals in the community who primarily use sign language for effective expression and communication. Social AI serves as an integrated platform combining **face detection, natural language processing, and sign language recognition, enabling facial recognition and interactive Q&A sessions with the people**. The platform **translates sign language gestures into meaningful speech** or text displayed on the screen.

Mohd Amiruddin Abd Rahman, Caceja Elyca Anak Bundak, Nurin Syazwina Mohd Haniff, Nur Athirah Mohd Shazali, Siti Fairuz Mat Radzi, Athiyyah Qistina Abdul Hakim, Lokman Hakim Muhamad, Muhammad 'Aqil Syahiran Izham, Badrul Munir Mustafa Kamal
mohdamir@upm.edu.my 2024

How Social AI Works

O1 Facial Recognition
This technology uses face detection to recognize a person's face and identifying them.

O2 Speech & Sign Language Recognition
The computer vision system capable of recognizing and interpreting sign language gestures and capture person's speech.

O3 AI Assistant
An application program form of NLP, that understands natural language commands and completes tasks for the user.

O4 Text to Speech
Synthesis voice responce that translates the users commands with text-to-speech software.

OKU AI — for AI VOICE CHAT
1. ALIGN YOUR FACE TOWARDS THE CAMERA
2. ASK YOUR QUESTIONS THROUGH THE MICROPHONE
3. VIEW THE ANSWER THORUGH THE SCREEN

Sembangbot — for SIGN LANGUAGE RECOGNITION SYSTEM
1. DO SIGN LANGUAGE [ALPHABET]
2. LISTEN TO THE VOICE OUTPUT
3. VIEW THE TRANSLATED GESTURES