AI-Based Real time analysis and control of the monitoring on the growth of Freshwater prawn using video image processing from underwater drone

Dr Lim Tiong Hoo

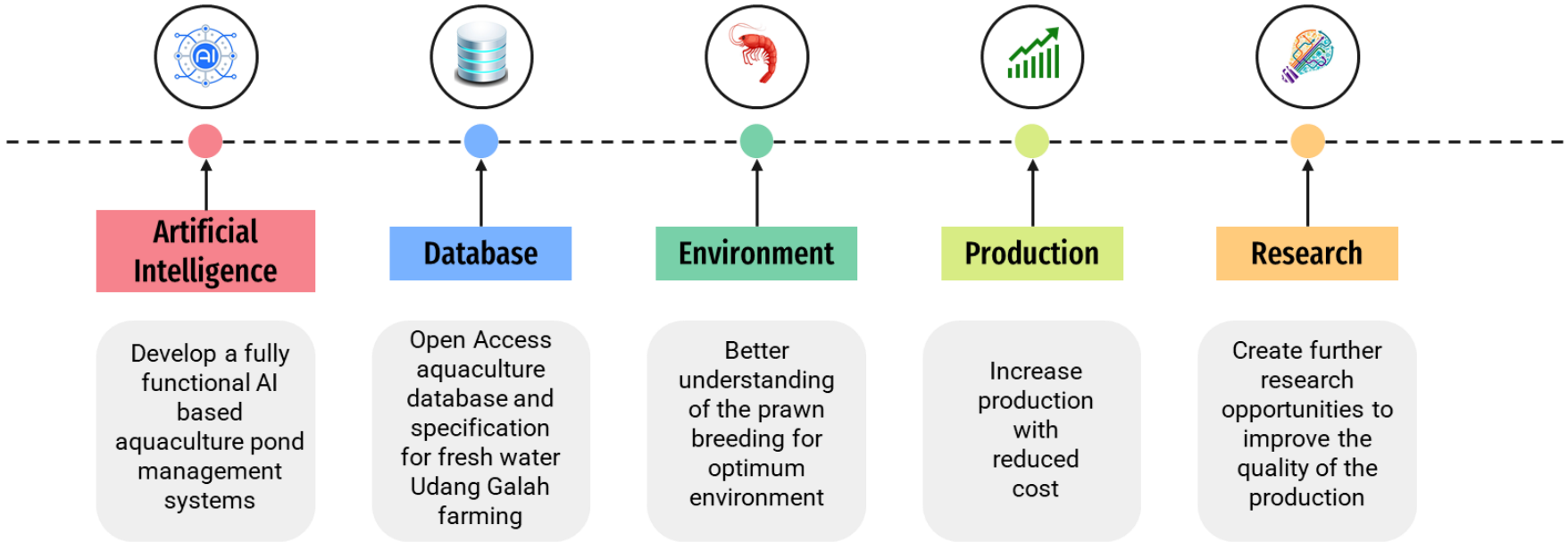
Universiti Teknologi Brunei

Project Title: AI-Based Real time analysis and control of the monitoring on the growth of Freshwater prawn using video image processing from underwater drone

Background :

To address food security, the number of aquaculture activities for offshore and onshore fish and prawn farming have increased significantly in ASEAN countries for the last 20 years. However, the production rate from small medium enterprise has been low especially for onshore prawn aquaculture. Farmers are still rely on traditional manual approach to monitor the growth of the cultures and manage the ponds. In this interdisciplinary project, an AI based recognition system is proposed to monitor the growth of Macrobrachium Rosenbergii using video images and sensors data taken from production aquaculture ponds with different water qualities.

Targets:



Speaker: **Tiong Hoo Lim (UTB, Brunei)**

Project Title: AI-Based Real time analysis and control of the monitoring on the growth of Freshwater prawn using video image processing from underwater drone

Project Members :

Leader: Tiong Hoo Lim (UTB, Brunei)

Members:

- Aida Maryam Basri (UTB, Brunei),
- Suriayati Chupra (UTM, Malaysia),
- Seno Adi Putra (Telkom U, Indonesia) ,
- Hanif Kafhrurroja (IIS, Indonesia)

Associate Project Members:

Mr Zuhairi Hj Azahari (ODE, Aquaculture and Agriculture Company, Brunei),
Mrs Tek Ying Khoo (Fisheries Department, Ministry of Primary Resource and Tourism, Brunei),
Dr Peng Cheng Liu (University of York, UK)

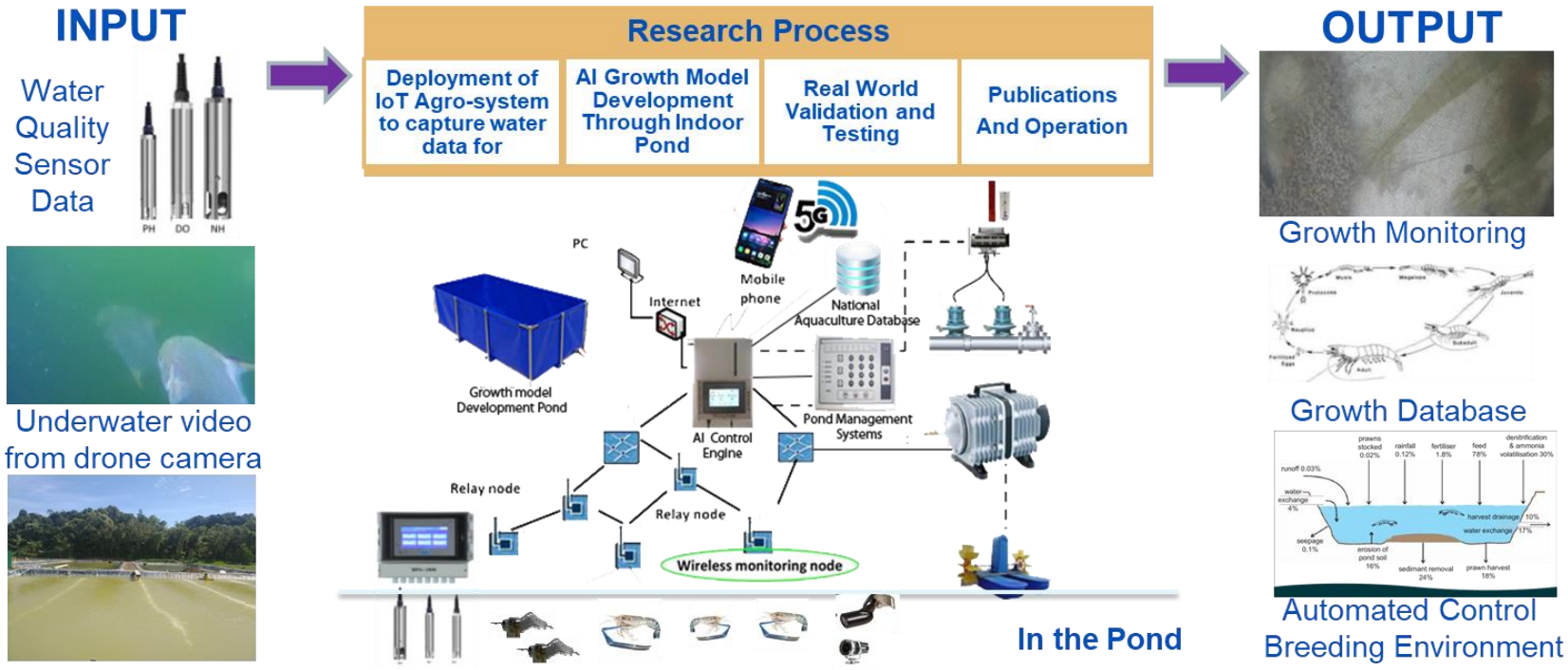
Project Duration :

12 Months

Project Budget:

USD $38,100

Project Activities: (Max. 3 slides)



- Development of IoT Aquaculture Pond (Real and Control) (UTB,BRIN, TELKOM)
- The study of prawn growth using IoT technologies (BRIN, TELKOM and UTB)
- The use of CNN algorithm such as YOLO for the Classification of prawn age (ALL)
  - Extra small, Small, Medium, Large, Extra large
- The detection of prawn age using Artificial Intelligence (UTB, UTM, TELKOM, UoY)
- The study of the quality of the wild and breeding prawn (UTB and DoF)

Project Activities: (Max. 3 slides)

Devolopment and Deployment of IoT aquaculture farm

- Dr Lim Tiong Hoo (UTB)
- Seno Adi Putra (Telkom U, Indonesia) ,
- Hanif Kafhrurroja (BRINS, Indonesia)
- Suriayati Chupra (UTM, Malaysia),

Construction and optimization of the prawn growth model using machine learning

- Dr Lim Tiong Hoo (UTB)
- Suriayati Chupra (UTM, Malaysia),
- Seno Adi Putra (Telkom U, Indonesia),
- Hanif Kafhrurroja (BRINS, Indonesia)
- Dr Peng Cheng Liu and team (University of York, UK)

Study of the prawn quality

- Sampling Taking for data training and Analysis
  - Dr Lim Tiong Hoo (UTB)
  - Aida Maryam Basri (UTB, Brunei),

Stakeholder information sharing

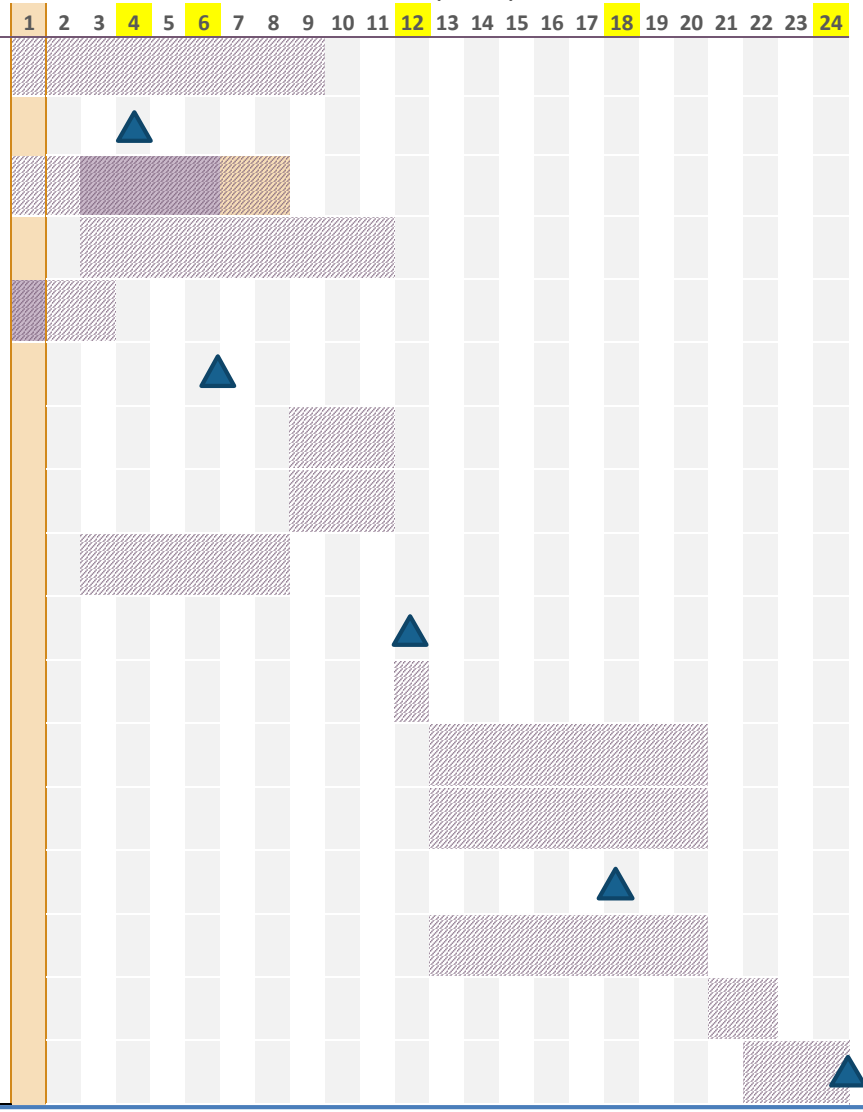
- Mr Zuhairi Hj Azahari (ODE, Aquaculture and Agriculture Company, Brunei) – Access to the pond
- Mrs Tek Ying Khoo (Fisheries Department, Ministry of Primary Resource and Tourism, Brunei) – Expert advice on the current breeding environment

Select a period to highlight at right. A legend describing the charting follows.

Period Highlight: 1

Plan Duration | Actual Start | % Complete | Actual (beyond plan

ACTIVITY	PLAN START	PLAN DURATION	ACTUAL START	ACTUAL DURATION	PERCENT COMPLETE
Procurement of research items, appointment of research assistant(s)	1	9	0	0	0%
(Deliverable - Work Plan Schedule Report)					
Samples collection for analysis from field site	1	6	3	6	0%
Developing and Testing of the growth model	3	9	0	0	0%
Field Survey and Preparation of ponds for field trials	1	3	1	0	
(Deliverable - IoT monitoring systems with status report)					
Deployment of system on field site	9	3	0	0	0%
Optimisation of operational parameters	9	3	0	0	0%
Experimentation on various variables	3	6	0	0	0%
(Deliverable - Onsite operation of the water monitoring systems with status report)					
Ideal system configuration specifications	12	1	0	0	0%
Systems Evaluation and Operational field data capture	13	8	0	0	0%
Monitoring and collecting data on water quality	13	8	0	0	0%
(Deliverable - Preliminary research finding report)					
Systems Modification and Validation of collected data with standard lab methods	13	8	0	0	0%
Data analysis and evaluation	21	2	0	0	0%
Technical report (Deliverable - Final Report)	22	3	0	0	0%



R&D results: Preliminary Image captured from underwater drone

Pond with prawn age 2 weeks and aerator

Pond with no aerator with Tilapia fish

Scientific Contribution: Presentation in International Conferences

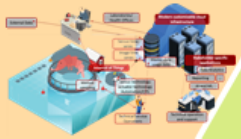
No:	Paper title:	Author names	Affiliation	Conference name:	The date of the conference	The venue of the conference
1	Detecting diseases in Chilli Plants Using K-Means Segmented Support Vector Machine	Bin Abdul Wahab, A.H., Zahari, R., **Lim, T.H.**	Universiti Teknologi Brnei	3rd International Conference on Imaging, Signal Processing and Communication	27 July 2019	Singapore
2.	Social Media and E-Commerce Analysis on Aquaculture Supply Chain Management: A Case Study on Freshwater Lobsters	Hanif Fajri, **Hanif Fakhrurroja,** Muharman Lubis	Telkom University, National Research and Innovation Agency	The International Conference on Advancement in Data Science, e-Learning, and Information System (ICaDEIS 2022)	23-24 November 2022	Telkom University, Bandung, Indonesia & İstanbul Nişantaşı Üniversitesi, Turkey,
3	Classification of Building Cracks Image Using the Convolutional Neural Network Method	I Gede Pasek Suta Wijaya; Aditya Perwira Joan Dwitama; Ida Bagus Ketut Widiartha; **Seno Adi Putra**	Telkom University	International Conference on Advancement in Data Science, Elearning and Information Systems (ICADEIS)	20-21 October 2020	Lombok Indonesia
4	Taxonomy of Cyber Threat Intelligence Framework	Ahmad Naim Irfan, **Suriayati Chuprat,** Aswami Ariffin	Universiti Teknologi Malaysia	2022 International Conference on ICT Convergence (ICTC)	19-21 October 2022	Jeju Island, Korea
5	Evaluating the effectiveness of wrapper feature selection methods with artificial neural network classifier for diabetes prediction	Fahmiin, M.A., **Lim, T.H.**	Universiti Teknologi Brunei	Lecture Notes of the Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering	7-8 December 2019	Changsha, China,

Scientific Contribution: Journal Papers

No:	Paper title:	Author names	Affiliation	Journal name:	The publisher of the Journal	The volume number and Pages
1	Multiagent Architecture for Bridge Capacity Measurement System Using Wireless Sensor Network and Weight in Motion	**Seno Adi Putra**, Bambang Riyanto Trilaksono, Muhammad Riyansyah, **Dina Shona Laila**	Telkom University	IEEE Transactions on Instrumentation and Measurement,	IEEE	2021, 70, 1, 1557-966
2.	Development Of Temperature Control and Monitoring System For Precision Aquaculture Based on Internet of Things	Tauriq Fuji Nur Akbar, **Hanif Fakhrurroja,** Hollanda Arief Kusuma	Universitas Maritim Raja Ali Haji, **National Research and Innovation Agency**	The 1st International Conference on Sustainable Engineering Development and Technological Inovation (ICSEDTI) 2022	Oktober 11-13, 2022	Aston Tanjung Pinang Hotel & Conference center, Tanjung Pinang, Kepualaun Riau,
3.	Designing an IoT-Based Freshwater Crayfish Cultivation Monitoring Dashboard	Sonia Marselina, **Hanif Fakhrurroja**, Betha Nurina Sari	Universitas Singaperbangsa Karawang, National Research and Innovation Agency	The 1st International Conference on Sustainable Engineering Development and Technological Inovation (ICSEDTI) 2022	Oktober 11-13, 2022	Aston Tanjung Pinang Hotel & Conference center, Tanjung Pinang, Kepualaun Riau,
4	Synergistic antioxidant activity of selected medicinal plants in Brunei Darussalam and its application in developing fortified pasta	Tashim, N.A.-Z., Lim, S.A., **Basri, A.M.**	Universiti Teknologi Brunei	Journal of the Science of Food and Agriculture	Journal of the Science of Food and Agriculture	2022
5	Students' Characteristics of Student Model in Intelligent Programming Tutor for Learning Programming: A Systematic Literature Review	Rajermani Thinakaran, **Suriayati Chuprat**	Universiti Teknologi Malaysia	International Journal of Advanced Computer Science and Applications	The Science and Information Organization	Volume 13 Issue 7,.pp. 669-676
6	Toward stable soil control system for sustainable water irrigation system in agriculture	Ghaffar, Khairuddin;Salleh, Umi F. H. M.;Gapar, Noorzafirah;Ismail, Rofiani;Hassan, Syed Bilal;Sarbini, M. Adi M.;**Lim, Tiong Hoo**	Universiti Teknologi Brunei	Advanced Science Letters	Advanced Science Letters	2016, 22(10), pp. 2661–2665

Societal Impact: Project Target

- **Improve farm management and water treatment.**
- Better working environment.
- Support green and blue Aquaculture.



- **Reduce growth time from 5 to 4 months.#**
- **Increase survival rate by 20%.#**
- Reduce wastage on feed.

Optimum & Economical Breeding

- **Increase Aqua-tech activities.**
- Create new job opportunities.
- Attract investment.
- Encourage Agro-business.

New Opportunities

Economical Benefit

- **Increase productions** (from **7980 kg** to **9576 kg**).*
- **Lower operation costs.**
- Increase ODE contribution to Brunei freshwater prawn production to **44.7%**.*

Goal 2

Goal 3

Goal 3

Brunei Wawasan 2035

Goal 1

Goal 2

Goal 1

- **Generate new knowledge.**
- Improve aquafarm methods.
- Identify best practices.
- Provide innovative farming.

Knowledge Transfer

Social Benefit

- **Address food security through sustainable aquaculture.**
- Improve socio-economic independence.
- Provide source of protein.

- **Sharing of Aqua-cloud with farmers.**
- Digitalization and Agro-data analytics.

Digital Wealth

- **IR-4.0 Ready Aquaculture systems.**
- Technology transfer to new industry.

Conclusion:

- Identification of Machine Learning Algorithm for bad quality images
- Visibility issues
  - Water Turbidity due to the aerator and oxygen water
  - Size and colour of the prawn
- Locate prawn population location to monitor
  - Large pond and scattered Prawn
  - The use of Sonar to locate subject
- Water movement and Dynamic Environment
  - Need a control environment to test and build the model

Future works:

1. Deployment of the IoT Pond Water Quality Monitoring Systems (BRIN, TELKOM, UTB) - **Ongoing**
2. Visit to the BRIN Lobster Farm (UTB, BRIN, TELKOM and UTM) – **January 2023**
3. Purchase and Delivery of Equipment for ASEAN IVO (UTB) – **December 2022**
4. Construction of control pond to develop the growth model (BRIN, UTB, TELKOM) – **February 2023**
5. Training and Testing of the AI Based prawn growth model. (TELKOM, UTM, UTB - **Ongoing**)
6. Field testing of the Prawn Growth Model in the real pond. (UTB)
7. ASEAN-UK Aquaculture Knowledge Sharing Workshop. (ALL Members and invited researchers, April 2023)