Background :

Most people **in rural and semi-urban areas** afflicted with ocular diseases were diagnosed late due to **a lack of ophthalmologists** and **costly immobile equipment**. Digital ocular screening exists yet available in some places, especially in urban areas. Mobile applications are the current niche in healthcare, even for screening or analysing non-communicable ocular diseases (NCODs). Many industries are actively adopting mobile phone technology, and this does not make the healthcare industry left behind. This technology is a promising platform that can offer cost-effective solutions as the combination of smartphones and cloud computing facilitates a scalable solution. To make the best of the situation, the Internet of Things (IoT) has shown potency, representing an ideal solution to the limited medical attention received by people in developing countries. The IoT allows health practitioners and clinicians to **conduct patient monitoring and diagnosis remotely and regularly.** An integrated decision support system (DSS) using a collaborative cloud and machine intelligence approach may advance the prediction of NCODs, which inadvertently gives health practitioners and clinicians an efficient and prompt system that allows them **a second opinion** on a diagnosis.
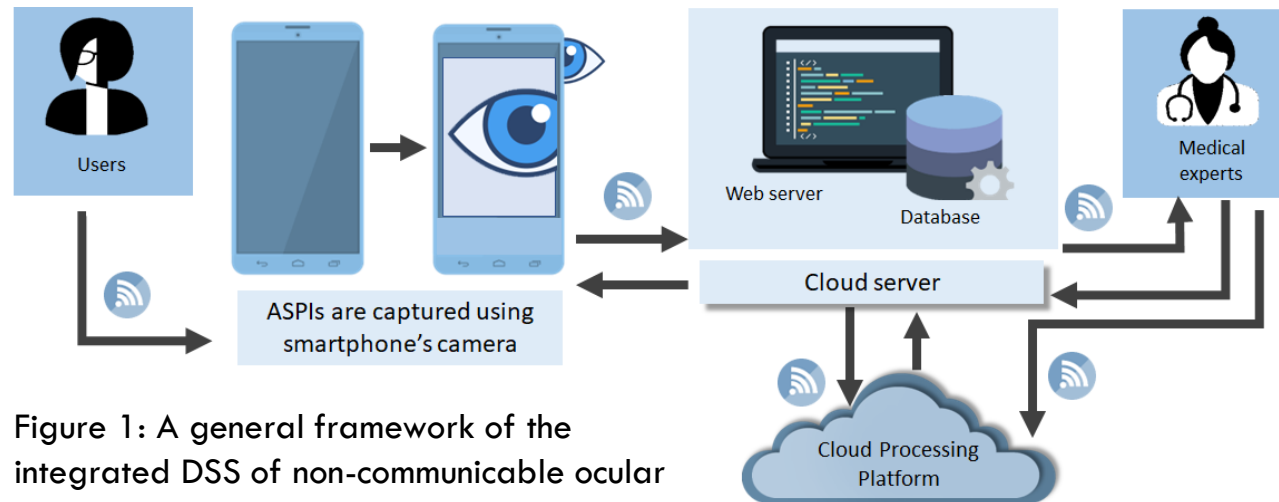

Figure 1: A general framework of the integrated DSS of non-communicable ocular diseases using ASPIs.

Targets:

To develop an integrated cloud-based DSS for NCODs to detect anterior segment ocular diseases using machine intelligence, cloud technology and an integrated system approach.

1. *Development of the Decision Support System to screen anterior segment-related NCODs using ASPIs captured using smartphone cameras.*
2. *Development of machine intelligence models with the best classifier that provides the highest classification and prediction accuracies to detect identified anterior segment NCOD*
3. *Societal, health and well-being impact analysis with the underprivileged old folks and rural communities*

Speaker: Wan Mimi Diyana Wan Zaki

Project Members :

UKM (MYS): Wan Mimi Diyana Wan Zaki (Project Leader) — UKM (MYS): Aini Hussain — UKM (MYS): Mohamad Hanif Md Saad — UKM (MYS): Haliza Abdul Mutalib — UKM (MYS): Wan Haslina Wan Abdul Halim — UKM (MYS): Rosilah Hassan — ITC (KHM): Dona Valy — ITB (IDN): Acep Purqon

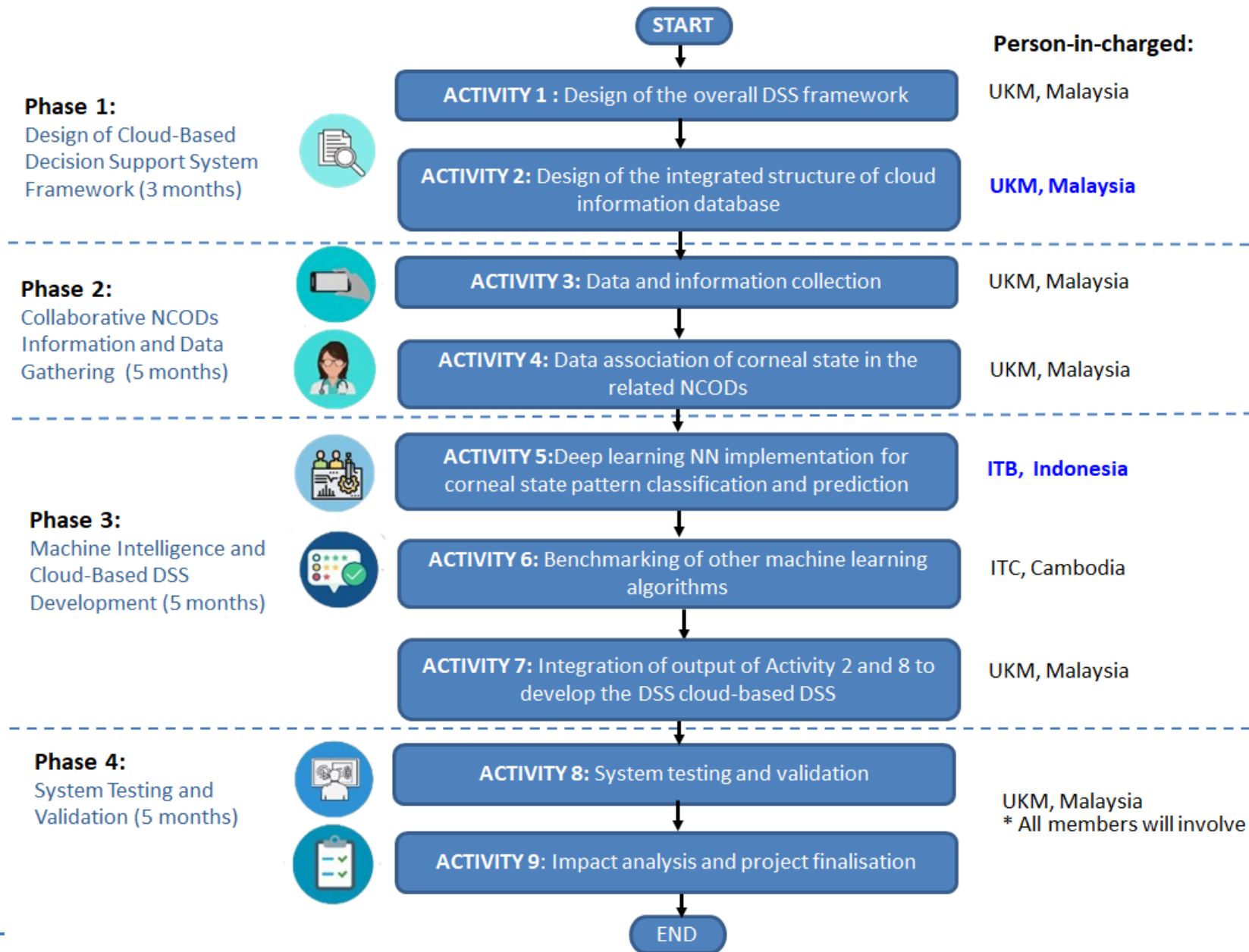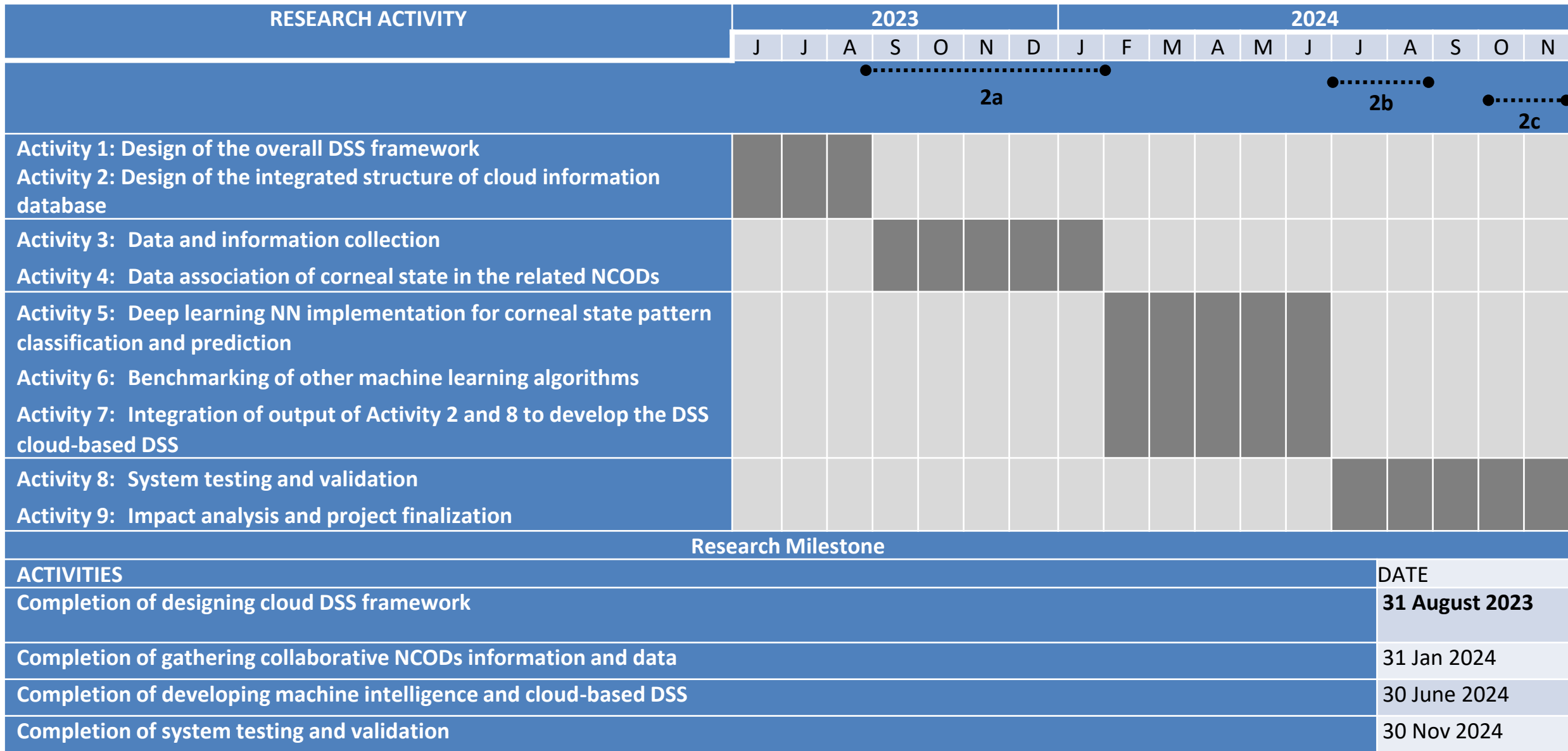| Members	Expert in fields
Assoc. Prof. Dr. Wan Mimi Diyana Wan Zaki (Leader)	Medical image processing and intelligent system
Prof. Dr. Aini Hussain	Intelligent engineering system
Assoc. Prof. Dr. Mohammad Hanif Md Saad	Applied intelligent system
Assoc. Prof. Dr. Haliza Abdul Mutalib	Optometry and vision sciences
Assoc. Prof. Dr. Wan Haslina Wan Abdul Halim	Consultant ophthalmologist
Assoc. Prof. Ts. Dr. Rosilah Hassan	Mobile communication
Dr. Dona Valy	Computer vision
Assoc. Prof. Dr. Acep Purqon	Mathematical modelling

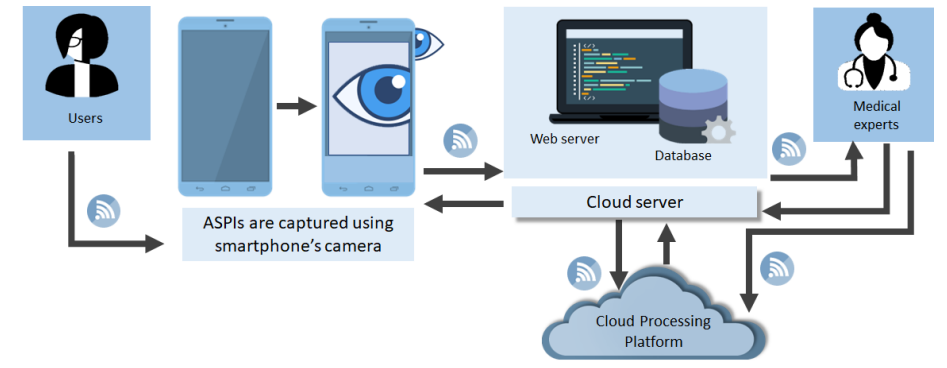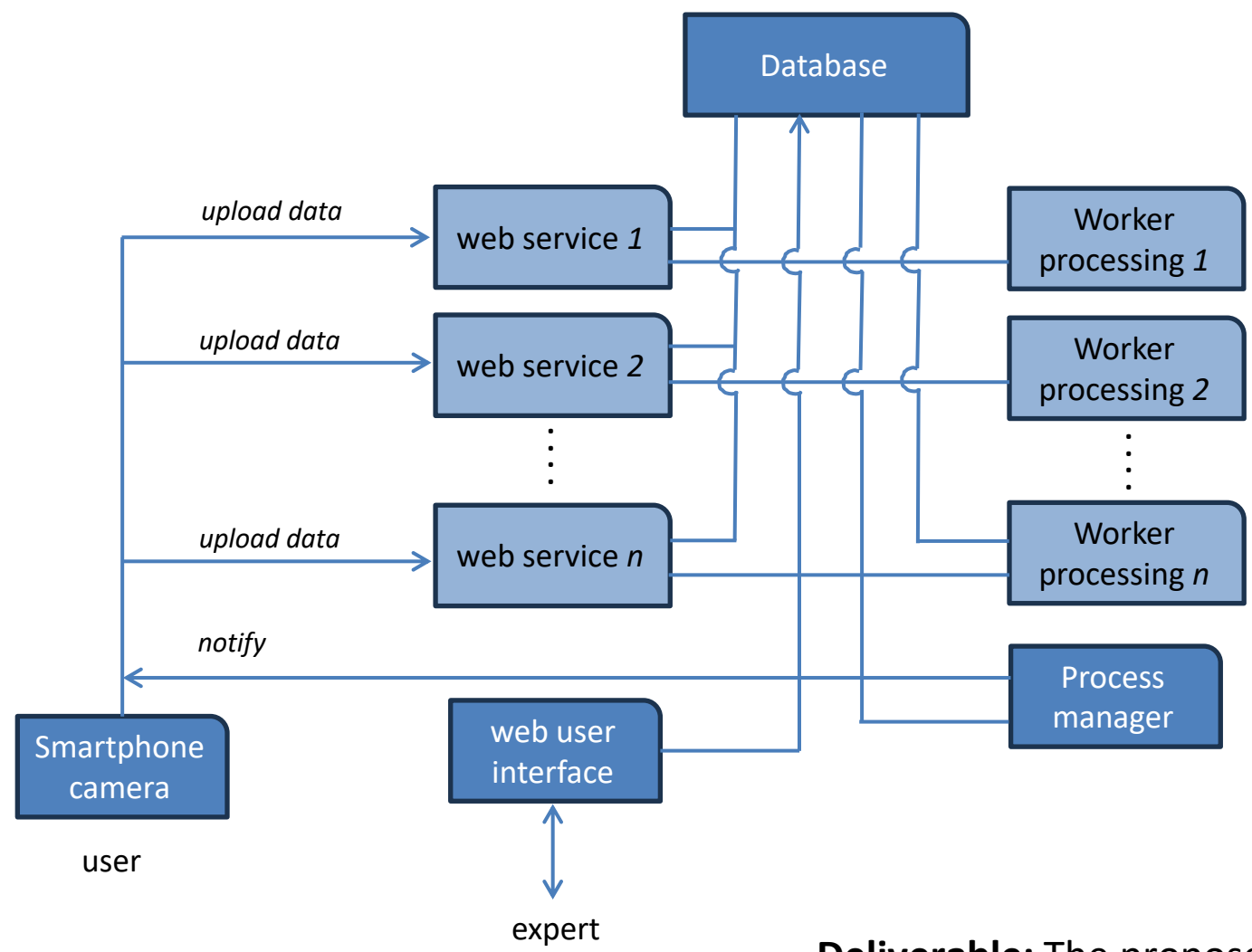**Project Duration :** 1 June 2023- 31 Nov 2024 (18 months)

Project Budget:

Item	Price per pax	# Of Pax	# Of Day	Total Year 1 (USD)	Total Year 2 (USD)
1. Equipment/ Software					
XOJO Pro Edition	799	2		1598	1598
Rental of Dedicated Server for Web Service Hosting with new domain	750			750	750
High performance laptop for mobile tests	2000	1		2000	
Total:				4348	2348
2a. Travel: Data collection and information gathering in Malaysia (Sept 2023 - Feb 2024)					
Data collection in Malaysia x 3 trips (Accommodation, transport)	100	4	2/trip	1600	800
Total:				1600	800
2b. Travel: System testing and validation, and 1-day workshop in Cambodia (1 researcher from Indonesia & 3 researchers from Malaysia) - (July 2024 - Oct 2024)					
Economy roundtrip flight	400	4			1600
Accommodation and allowances	250	4	3		3000
Seminar room (workshop to the end users)	50	10	1		500
Ground transport	100	4	3		1200
Total:					6300
2c. Travel: Final meeting in Malaysia (1 researcher from Indonesia & 1 researcher from Cambodia) - (Nov 2024 - Dec 2024)					
Economy roundtrip flight	400	2			800
Accommodation and allowances	250	2	3		1500
Seminar room	60	8	3		1440
Ground transport	30	2	3		180
Total:					3920
3.Dissemination					
One article sent to an open access journal: USD 2,700					2700
				5,948	16,068
GRAND TOTAL (USD):				**22,016**	
(JPY):				**2,907,432.960**	

Flowchart of the project

START

Person-in-charged:

Phase 1:
Design of Cloud-Based Decision Support System Framework (3 months)

| ACTIVITY 1 : Design of the overall DSS framework | UKM, Malaysia |

| ACTIVITY 2: Design of the integrated structure of cloud information database | **UKM, Malaysia** |

Phase 2:
Collaborative NCODs Information and Data Gathering (5 months)

| ACTIVITY 3: Data and information collection | UKM, Malaysia |

| ACTIVITY 4: Data association of corneal state in the related NCODs | UKM, Malaysia |

Phase 3:
Machine Intelligence and Cloud-Based DSS Development (5 months)

| ACTIVITY 5:Deep learning NN implementation for corneal state pattern classification and prediction | **ITB, Indonesia** |

| ACTIVITY 6: Benchmarking of other machine learning algorithms | ITC, Cambodia |

| ACTIVITY 7: Integration of output of Activity 2 and 8 to develop the DSS cloud-based DSS | UKM, Malaysia |

Phase 4:
System Testing and Validation (5 months)

| ACTIVITY 8: System testing and validation | |

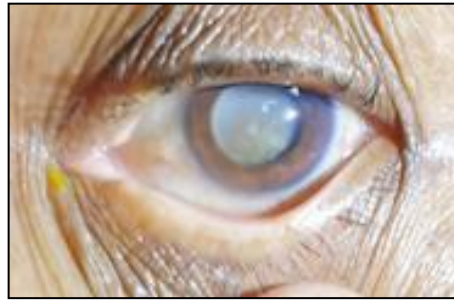| ACTIVITY 9: Impact analysis and project finalisation | UKM, Malaysia * All members will involve |

END

Deliverable: The proposed cloud DSS framework

What are the chosen non-communicable ocular diseases?
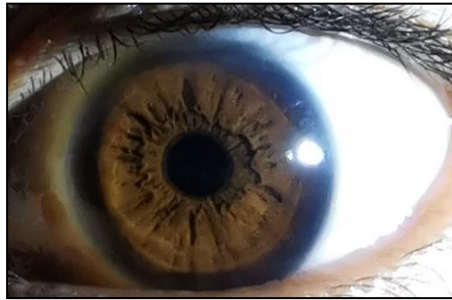
a) Normal   b) Pterygium   c) Cataract

Focusing on:

- The information and data gathering of the pterygium and cataract
- Establish the association of cornea state related to them to produce unique features

Note:

Since this project is a continuity from our previous projects (UKM/PPI/111/8/JEP-2022-554), an extension application from the Hospital Tunku Mukhriz Universiti Kebangsaan Malaysia (HCTM UKM) Ethical Committees.
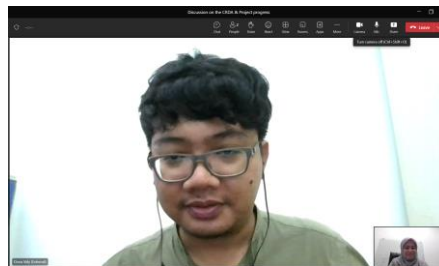
Project Activities (Discussions and meetings)
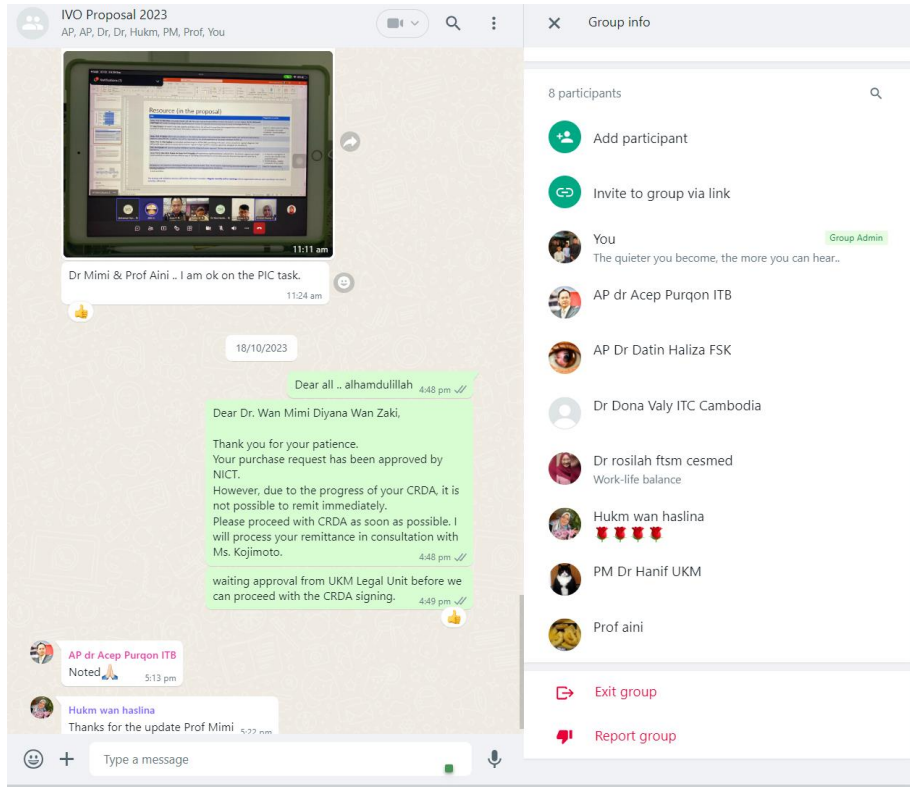
Project WhatsApp group: Our main communication channels

CRDA f2f discussion with Dr Acep from ITB in Bandung, September 1, 2023.

One of CRDA online discussion with Dr Dona from ITC on September 4, 2023.

The first virtual project meeting that involved all project members on September 29, 2023.

Conclusion:

- Digital health allows systems to take advantage of existing resources and infrastructure, providing more services directly in communities via telemedicine approaches proposed in this project –an integrated intelligent decision support system
- Ensuring healthy lives, promoting well-being at all ages, and reducing inequalities within and among countries is essential to sustainable development.