Title:

# AI-Powered Internet-of-Medical-Things System for Contactless Monitoring of Dengue Fever in ASEAN


Full name of Speaker: **Assoc. Prof. Dr. Van-Phuc Hoang**

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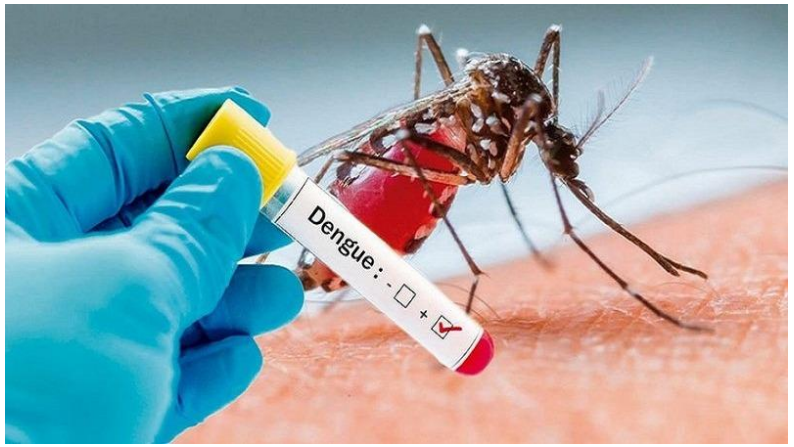


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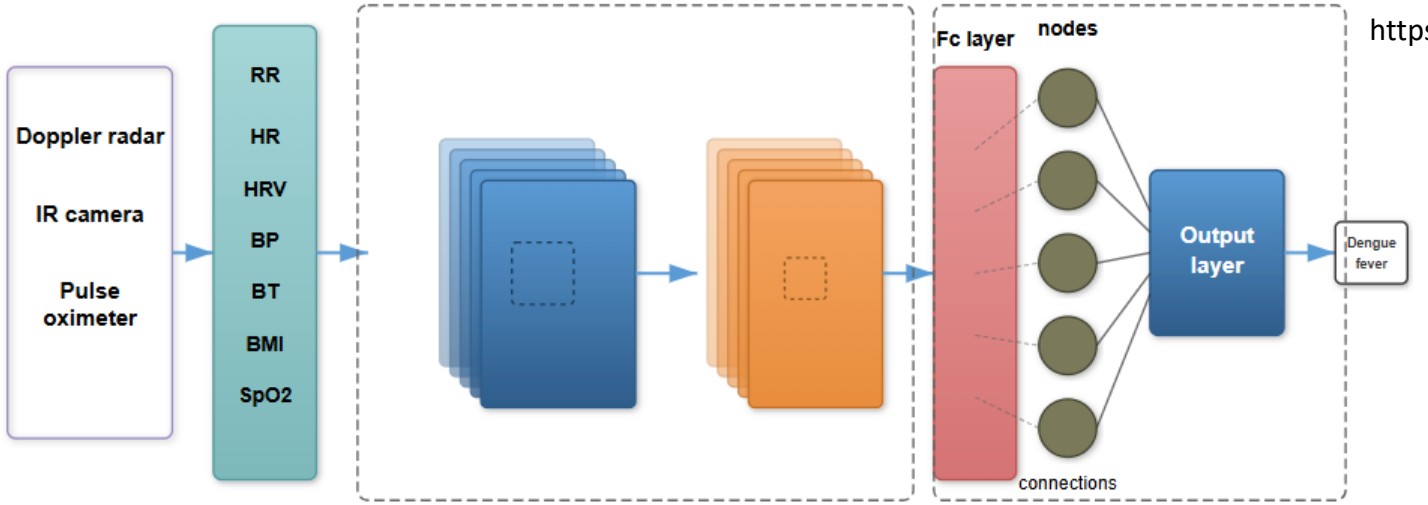


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# AI-Powered Internet-of-Medical-Things System for Contactless Monitoring of Dengue Fever in ASEAN


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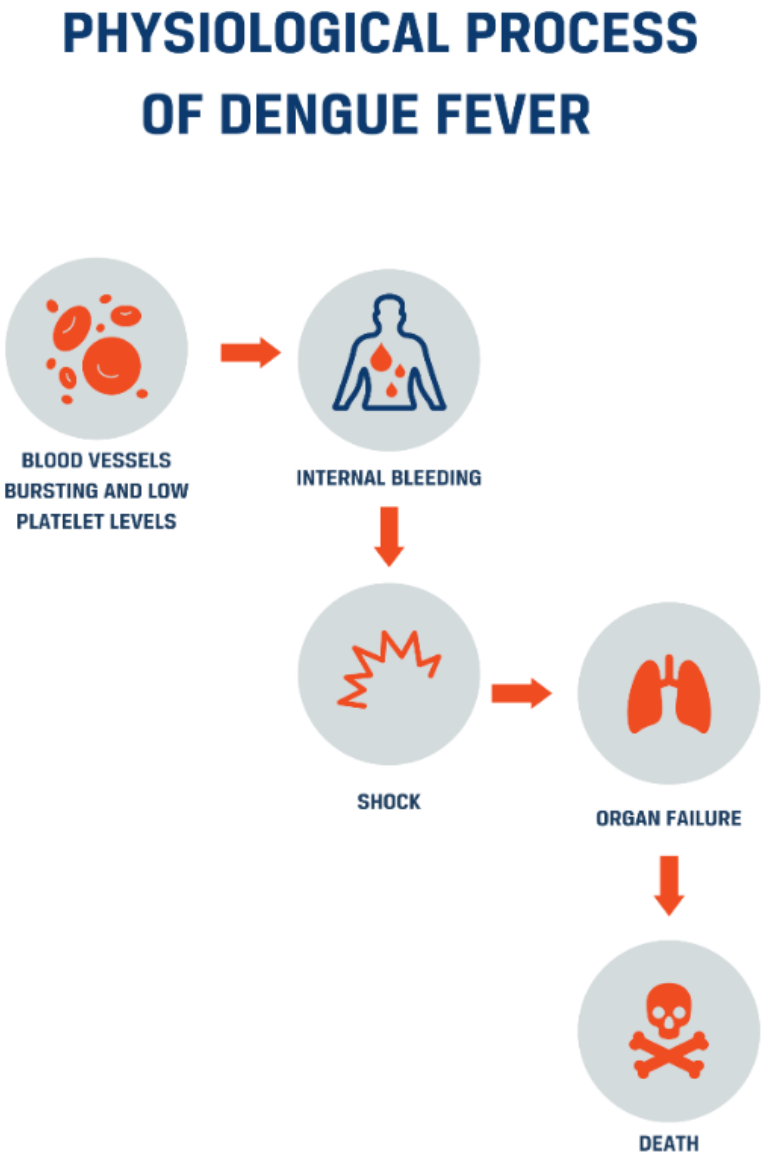
# AI-Powered Internet-of-Medical-Things System for Contactless Monitoring of Dengue Fever in ASEAN

Background :

- ✓ ASEAN countries face ongoing concerns about infectious diseases (especially Dengue fever) due to tropical climate.
- ✓ UNICEF notes a rise in Dengue fever infections across extensive parts of ASEAN due to climate changes.
- ✓ As of mid-2025, Vietnam has reported 28,787 dengue cases with five deaths
- ✓ Singapore recorded 13,655 dengue fever cases in 2024, representing an increase from the previous year, representing a concerning public health challenge across the ASEAN region.
- ✓ Cambodia reported the first six months of 2025 saw the increase trend worsen with 8,803 total dengue cases, an increase of nearly 30% compared to the same period in 2024.
- ✓ In recent years infections have been confirmed in a wide range of areas, including Japan, amid climate change.

Strict monitoring of vital signs is crucial for Dengue patients

This requires joint efforts from different countries in the region



# AI-Powered Internet-of-Medical-Things System for Contactless Monitoring of Dengue Fever in ASEAN

Targets:

1. Develop an IoMT system for infectious disease monitoring that
   a. Forms a connected network of 5 terminals located at VNU-UET, LQDTU and HMU in Hanoi, PIHCM in Ho Chi Minh city, and CDAT in Phnom Penh; Each terminal is equipped with a Doppler radar device, an infrared thermal imaging scanner, and a pulse oximeter.
   b. Obtains/Derives vital signs, including respiration rate, heart rate, heart rate variability, body temparature, and blood pressure with high precision by advanced signal processsing and deep learning techniques.
   c. Facilitates fast disease screening of Dengue fever by acquiring data from 100 Dengue patients and 200 normal control subjects.
   d. Enables status analysis of different stages of Dengue fever using machine learning techniques.
2. Faciliate joint student training across VNU-UET, LQDTU, UEC, NTU, CADT.

# Proposed method

## Work package 1: Data Acquisition (Non-contact & Non-invasive)

### Doppler Radar

- Distance: 30-40 cm
- Duration: ~10 seconds
- Position: Sitting/Standing
- Measure: Respiration,
- Heart activity

### Thermal Imaging

- Device: Boson (IR)
- Non-contact scanning
- Measure: Body temperature
- Initial fever screening

### Pulse Oximeter

- PPG measurement
- Blood pressure level
- Heart rate data
- Non-invasive

## Work package 2: IoMT Network (5 Terminals)

| VNU-UET | LQDTU | HMU | PIHCM | CADT |
|---|---|---|---|---|
| Hanoi | Hanoi | Hanoi | Ho Chi Minh | Phnom Penh |
| Normal control | Normal control | Dengue Patients | Dengue Patients | Normal control |

Target dataset: 100 Dengue Patients, 200 Normal control

# Proposed method

## Work package 3: Signal processing & Machine learning

**Signal Processing**

- → Advanced algorithms for environmental uncertainties
- → Ambient temperature compensation
- → Patient movement filtering
- → Signal interference reduction

**Deep Learning**

- → Transfer learning with UEC datasets (400 Dengue, 200 normal)
- → Disease stage classification
- → Pattern recognition for screening

## Work package 4: Derived Vital Signs ( High Precision)

- Respiration Rate
- Heart Rate
- Heart Rate Variability
- Body Temperature
- Blood Pressure
- SpO2
- BMI

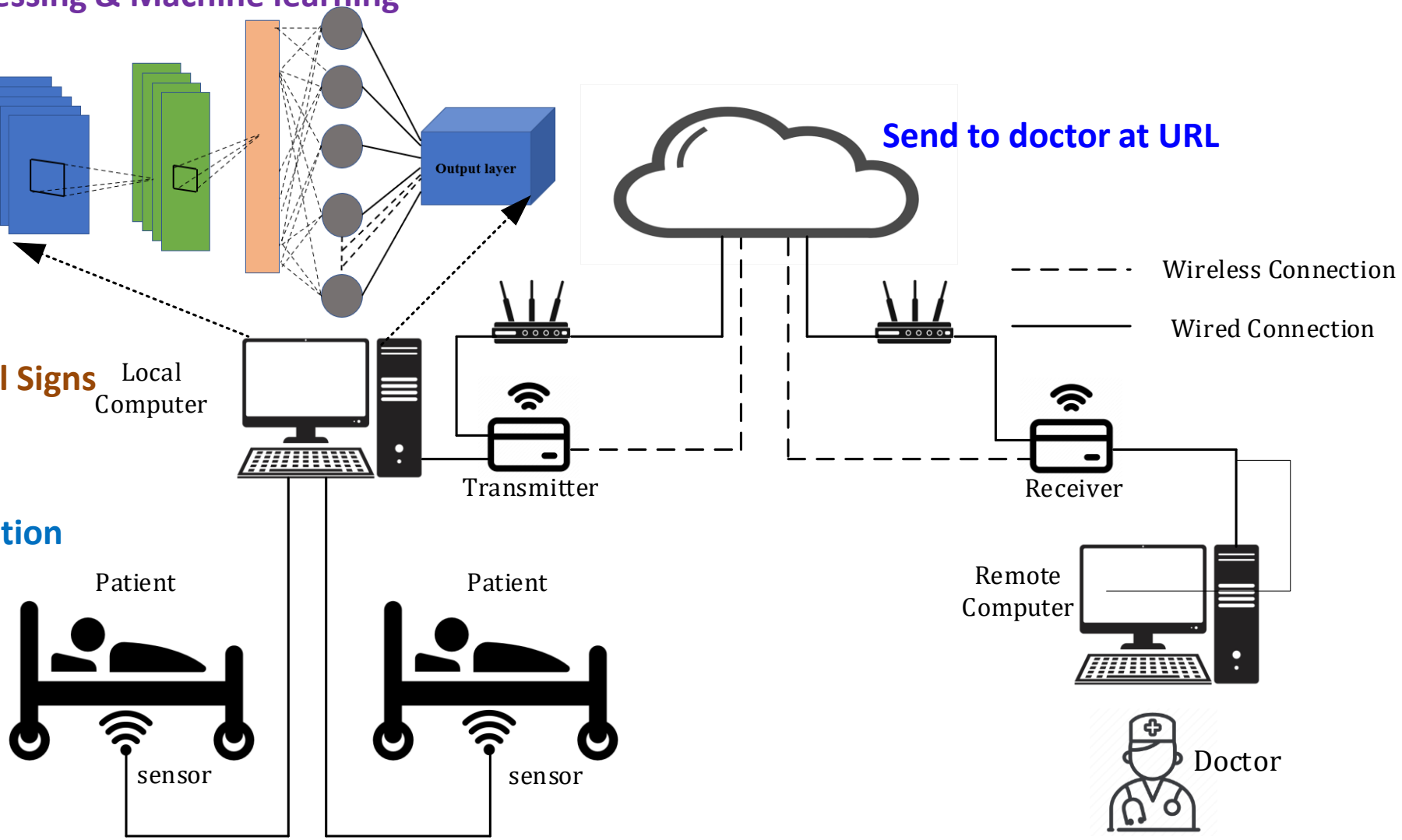
# Proposed method

## Signal processing & Machine learning

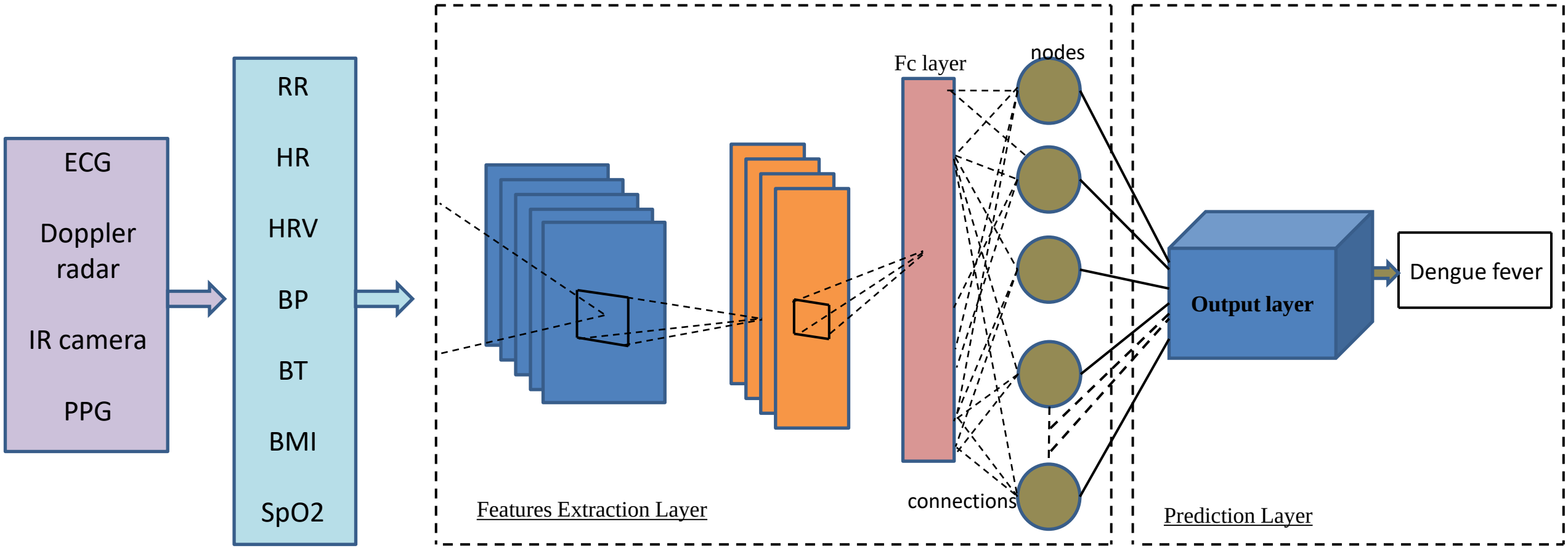



## Derived Vital Signs

## Data Acquisition



# Proposed method



# Key impact

## Current IoMT System (Foundation Phase)

**Limited Network**

5 terminals across Vietnam & Cambodia

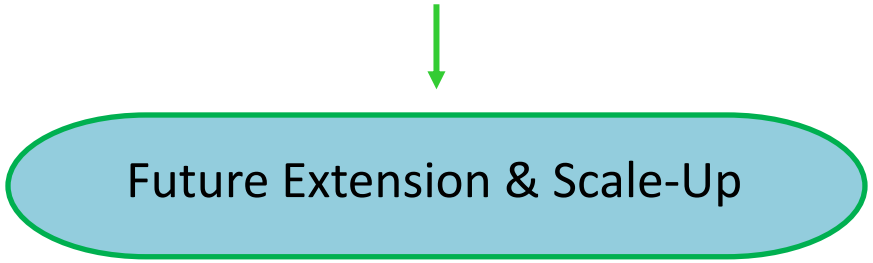
**Limited Data**

100 Dengue patients + 200 normal controls

**Current Limitation**

Not yet capable of disease outbreak monitoring

✓ Showcases possibility for future dynamic IoMT system



# Key impact

1

**Technology Showcase**

Demonstrates feasibility of extending to a **dynamic IoMT system** for disease outbreak monitoring across multiple infectious diseases

2

**Advanced Solutions**

Contributes **AI-powered solutions** for disease prediction, classification, and prevention across ASEAN countries

3

**Regional Collaboration**

Fosters **international collaboration** in AI for medicine and health for infectious diseases between Japan and ASEAN

## Long-term Vision

This foundational IoMT system establishes a **framework for broader ASEAN collaboration**, with planned future expansion for **diverse demographics and additional medical conditions** across Southeast Asian healthcare systems, addressing the urgent need for innovative monitoring and prevention systems in the region's tropical climate.

# Output/Outcome

## Output 1: IoMT System

**(a) 5 Terminals**

- VNU-UET (Hanoi)
- LQD.TU (Hanoi)
- HMU (Hanoi)
- PIHCMC (HCMC)
- CADT (Phnom Penh)

**(b) Vital Signs**

- Respiration Rate
- Heart Rate
- HR Variability
- Body Temperature
- Blood Pressure

**(c) Fast Screening**

- **100 Dengue Patients**
- **200 Normal Controls**

**(d) Stage Analysis**

- **ML-based status analysis of Dengue stages**
- Transfer learning with UEC datasets

## Output 2: Publications

**3** Journal Articles

**3** Conference Papers

## Output 3: Workshops

**Hanoi**

Progress discussion & dissemination

**Phnom Penh**

Progress discussion & dissemination

## Output 4: Student Training

**2** Bachelor

**2** Master

**2** PhD

Joint supervision: VNU-UET, LQD.TU, UEC, NTU, CADT

# Conclusion

**Targets**

- **IoMT Network:** 5 connected terminals (VNU-UET, LQDTU, HMU in Hanoi; PIHCM in Ho Chi Minh; CADT in Phnom Penh)
- **Vital Signs:** High-precision derivation of RR, HR, HRV, body temperature, blood pressure using AI/ML
- **Disease Screening:** Fast Dengue fever screening with 100 patients + 200 normal controls
- **Student Training:** Joint supervision of 6 students (2 bachelor, 2 master, 2 PhD) VNU-UET, LQDTU, UEC, NTU, CADT

**Method**

- **Data Acquisition:** Non-contact, non-invasive sensing using Doppler radar, thermal imaging, and pulse oximetry
- **IoMT Network:** 5 terminals across Vietnam & Cambodia collecting patient and control data
- **AI Processing:** Advanced signal processing & deep learning with transfer learning from UEC datasets
- **Vital Signs Derivation:** High-precision extraction of 5+ vital signs for disease monitoring
- **Clinical Application:** Fast Dengue screening and disease stage classification using ML

**Scientific and Societal Impact**

- **Technology Showcase:** Demonstrates feasibility of extending to dynamic IoMT system for disease outbreak monitoring across multiple infectious diseases beyond Dengue
- **Advanced Solutions:** Contributes AI-powered solutions for disease prediction, classification, and prevention across ASEAN countries facing tropical infectious diseases
- **Regional Collaboration:** Fosters international collaboration in AI for medicine and health for infectious diseases between Japan and ASEAN (Vietnam, Singapore, Cambodia)