Hybrid LoRa Network for Underserved Community Internet (LUCI)

Workshop on Communication in Extreme Environments for Science and Sustainable Development

Assoc Prof Dr Nor Fadzilah Abdullah (FKAB, UKM)

Prof Ir Dr Rosdiadee Nordin (FKAB, UKM)

Dr Asma' Abu Samah (FKAB, UKM)

Dr Rozita Ibrahim (PCU, UKM)

Dr Marco Zennaro (ICTP)

Dr Haider Al Obaidy (FKAB, UKM)

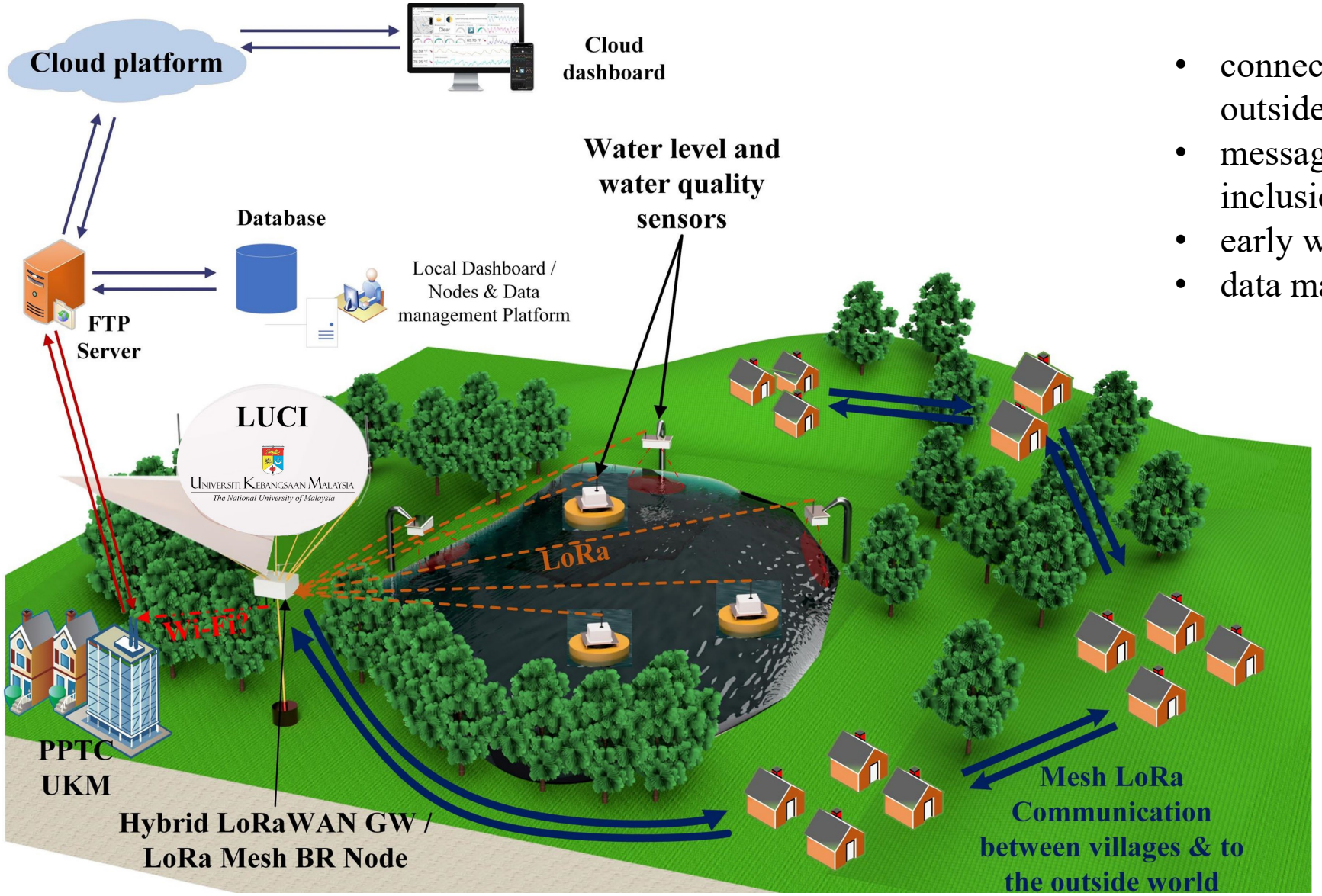
Nur Hasinah Najiah Maizan (FKAB, UKM)

Hybrid LoRa Network for Underserved Community Rural Internet Connectivity (LUCI)

- Problem: Lack of internet connectivity in underserved communities AND current water station data inaccessible to local community
- Solution: low-cost, low-power Internet connectivity using hybrid LoRa (i.e., LoRaWAN + Mesh LoRa)
- Target social impact: empower the local community's economic development and education

Figure 1. Existing BS connectivity to Orang Asli villages

LUCI: Network Architecture



- connectivity between villages and to the outside world
- messaging system that enables digital inclusion of illiterate community
- early water level warning
- data management platform

Figure 2. Conceptual design of the proposed system architecture for LUCI.

Project Component

LoRaWAN GW:

RAK Wireless WisGate Edge Pro V2/Lite 2

Pycom LoPy4/sPygate

LoRaMesh EN:

LILYGO® TTGO T-Beam & T-Echo

Meshtastic App

Allows users to connect their devices to a mesh network, forming a decentralized communication system.

TTN (The Things Network): platform for Water Level data

Enabling the transmission of real-time water level data to address critical needs in these communities

Telegram Bot for External Communication

Enabling people outside the coverage area to send and receive messages

2 subscription options:

- /subscribe_chat (Able to chat and receive updates)
- /subscribe_waterlevel (Receive water level update only)

Low-Level Alert (Caution):

Description: Indicates a slight increase in water levels

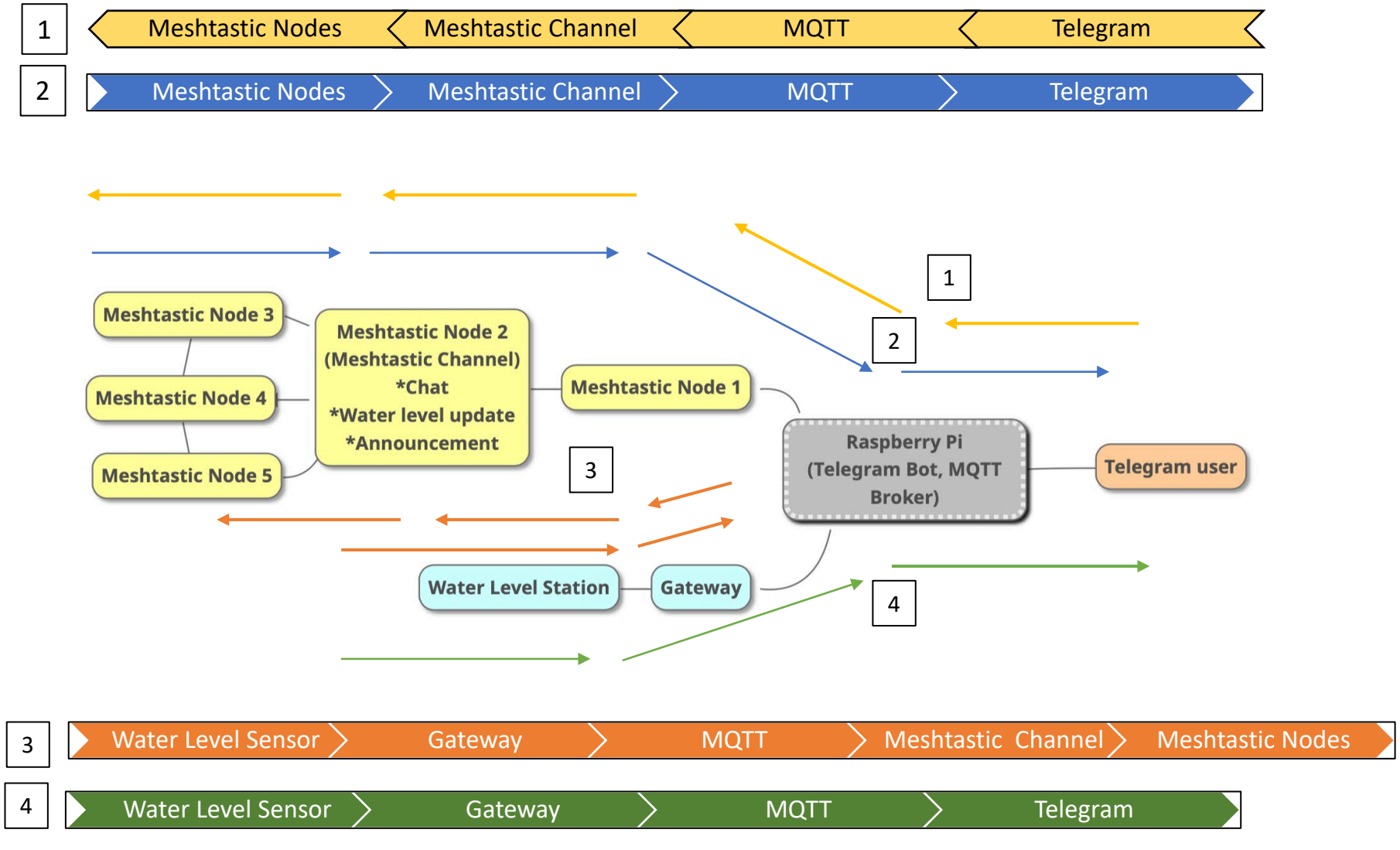
Moderate-Level Alert (Warning):

Description: Signifies a moderate increase in water levels, suggesting a higher risk of flooding

High-Level Alert (Emergency):

Description: Declares a state of emergency due to significantly elevated water levels, indicating an imminent risk of flooding. Evacuation orders may be issued, and emergency response teams should be activated. Residents should prioritize safety and follow official instructions for evacuation and emergency procedures.

Hybrid LoRa: Communication Infrastructure



Impact on the Community

Improved Communication Access:

Residents can easily connect with each other

Timely Water Updates:

Integration with The Things Network (TTN) ensures the community receives real-time water level updates.

Extended Connectivity Beyond Local Boundaries:

Telegram Bot allows individuals outside the community to communicate with other residents and external support.

Enhanced Emergency Preparedness:

Prompt weather alerts and communicate effectively allows the community to respond to emergencies e.g., flooding or drought.

Future development

Community Information Portal:

Create a website or cloud-based portal to host real-time weather updates, emergency resources, community announcements.

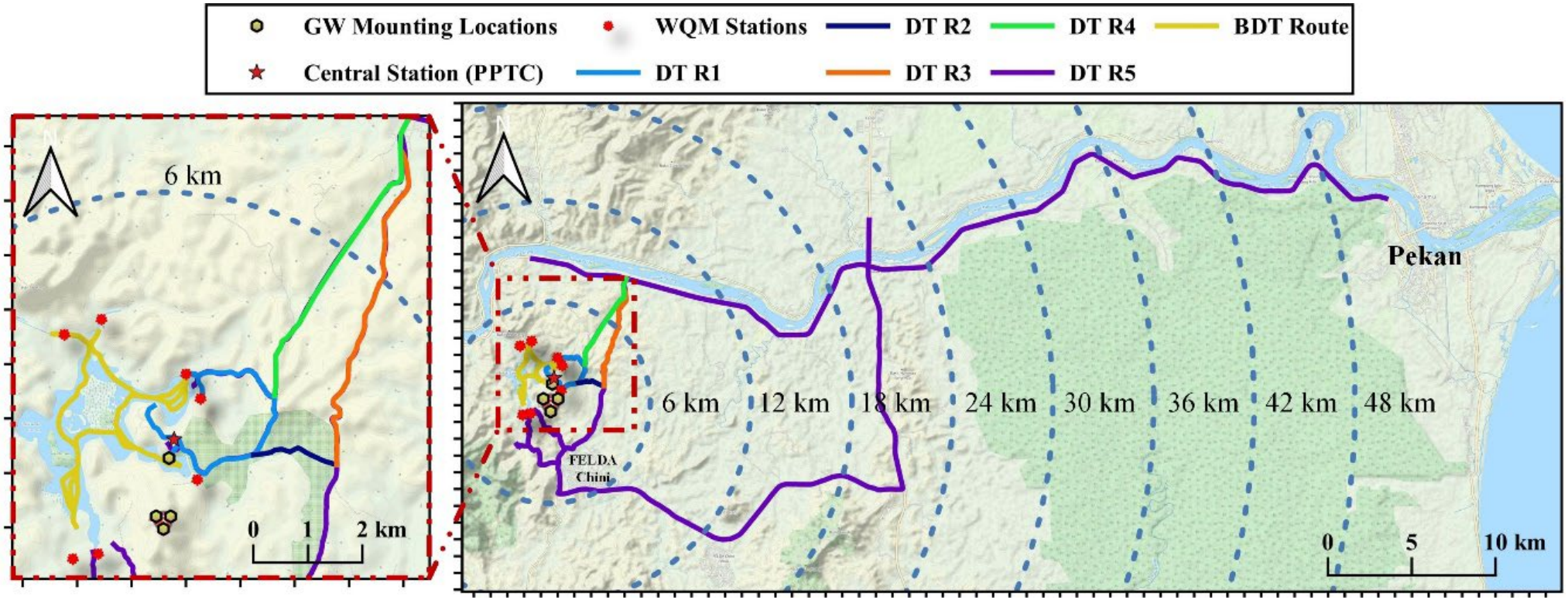
Cloud-Based Data Analytics:

Implement cloud-based data analytics to process and analyze the collected data more efficiently (e.g., advanced weather pattern analysis, predictive modeling for potential disasters, and insights into community-specific trends).

Extreme Communication POC

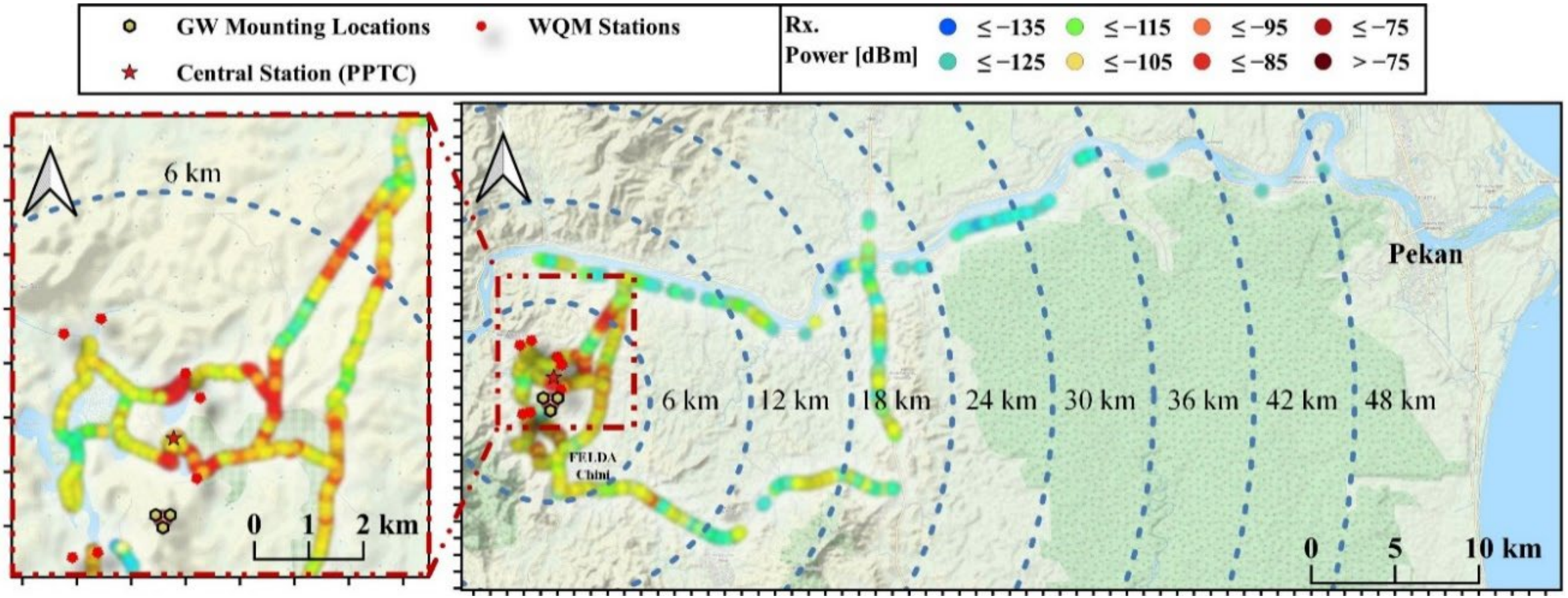
LoRa gateway deployment at Bukit Ketaya & measurement campaign around Tasik Chini (with Pahang Forestry Division): on 8 – 12 May 2023

Extreme Communication POC



BDT: boat drive test
DT: drive test

Extreme Communication POC



Community Outreach

Conclusion

- Through the integration of LoRa and IoT technologies and devices, we are able to create a resilient network that enhances local communication, provides real-time weather updates, and extends connectivity beyond geographic boundaries.

Universiti Kebangsaan Malaysia
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APNIC FOUNDATION

Wireless Research

The Abdus Salam International Centre for Theoretical Physics

Acknowledgement

- ISIF Asia, APNIC Foundation: KK-2021-020 / M-202106-00113
- ICTP/IAEA Sandwich Training Educational Programme (STEP)
- UKM's matching grant: DPK-2022-001

- Any questions, please contact: fadzilah.abdullah@ukm/edu.my