A mesh-topological, low-power wireless network platform for a smart watering system

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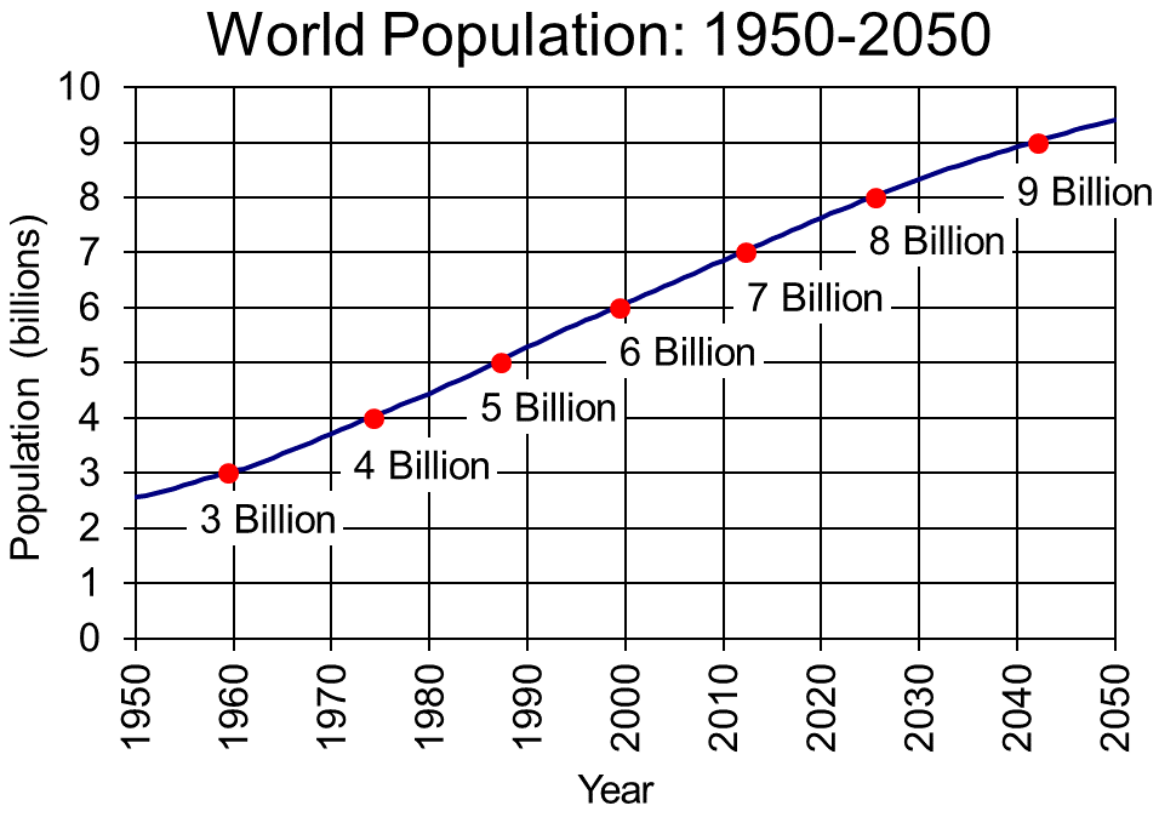
Background

- The world population is projected to reach almost 10 billion by 2050.*
- Food crisis becomes increasingly serious.
- The effective and intensive farming, or the smart farming, has been required to mitigate the food-supply problem.



* http://www.un.org/en/development/desa174 /news/population/2015-report.html

Figure source: US Census Bureau, International Data Base, August 2017 Update.

Our aim

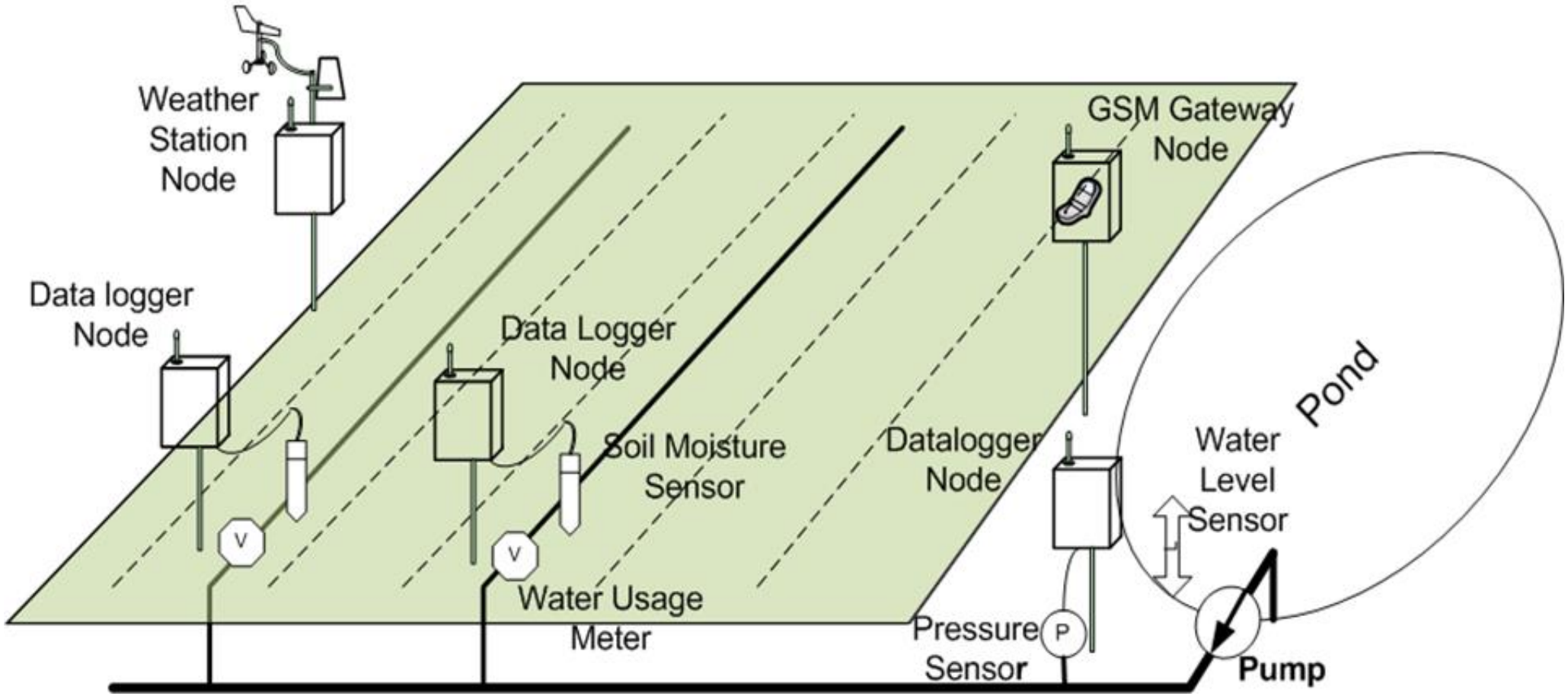
- Smart watering system based on a mesh-topological, low-power wireless network platform

Why watering system?

- It lies at the heart of agriculture since it directly affects product yields, as well as the quality of products.
- Controlling when plants should be watered and determining how much water the plants need concerning environmental conditions are crucial for the plant growth.

Figure source: Wikipedia.org

Smart watering system



Required properties of the WSN

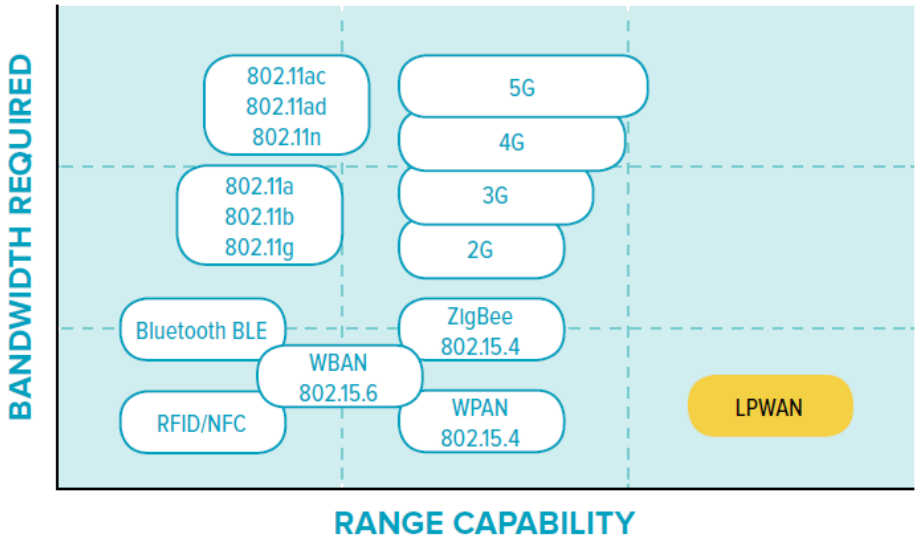
- Robustness
- Reliability
- Low power consumption

Objective

- To implement and test a prototype of the watering system based on the concept of mesh-topological, low-power wireless network platform, called a nerve network platform.

Our proposed solution: LoRa technology + NerveNet

- What is **LoRa**?
- Why **LoRa**?



	Local Area Network Short Range Communication	Low **P**ower **W**ide **A**rea (LPWAN) Internet of Things	**Cellular Network** Traditional M2M
	40%	**45%**	**15%**
☺	Well established standards In building	Low power consumption Low cost Positioning	Existing coverage High data rate
☹	Battery Live Provisioning Network cost & dependencies	High data rate Emerging standards	Autonomy Total cost of ownership
	Bluetooth 4.0 · ZigBee · Wi Fi	LoRa	GSM · 3G+ / H+ · 4G

Figure source: LoRa Alliance, A technical overview of LoRa and LoRaWAN, 2015

Figure source: Link Labs, Inc., Low Power, Wide Area Networks, 2016

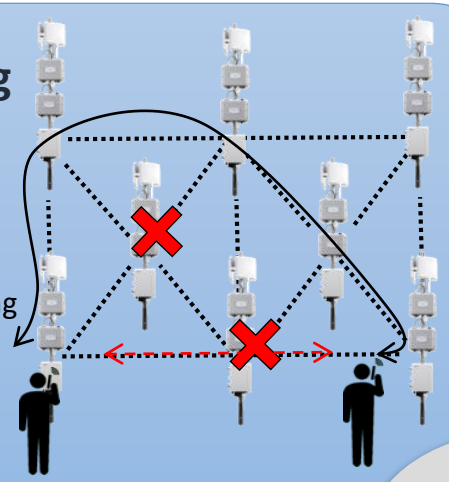
NICT's related project: the NerveNet

Phone & messaging

Available without the use of the Internet.

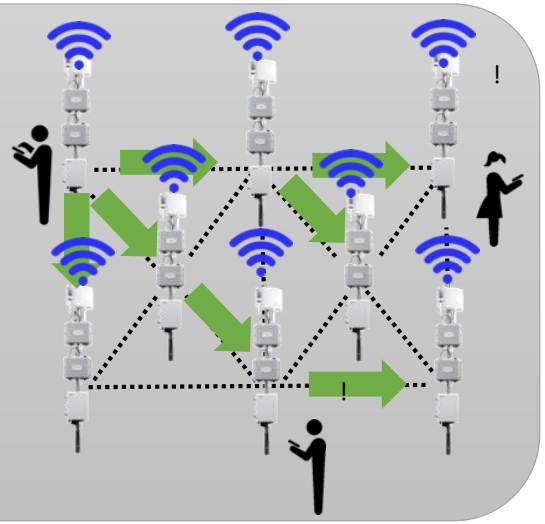
Automatic path switching

Real-time high-speed switching between overlaid multiple VLANs.



Message advertisement

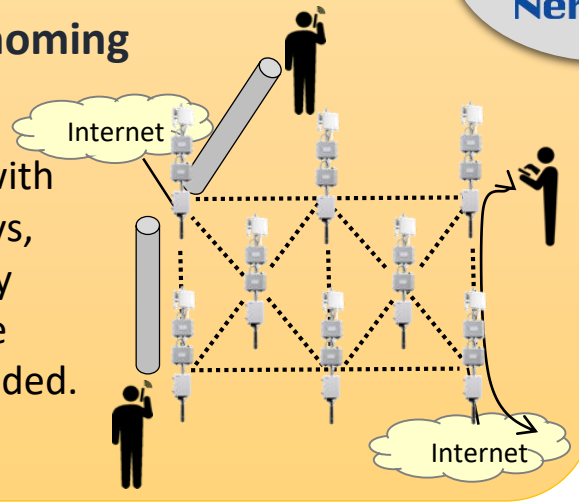
Real-time message push is available.



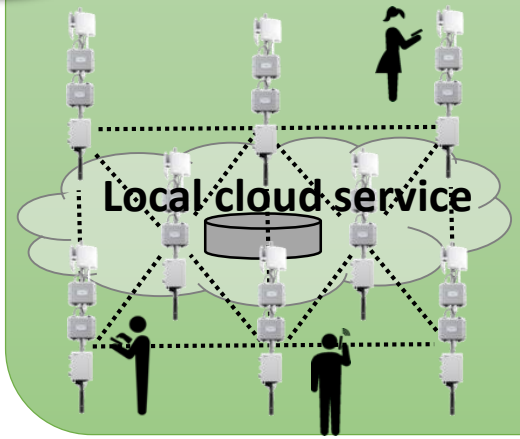
NerveNet

VPN & multi-homing

Load balancing with multiple gateways, and VPN gateway service to mobile devices are provided.



Local cloud & App service



NerveNet base station's distributed server and database system allows local cloud service on the local network.

NICT's related project: the NerveNet

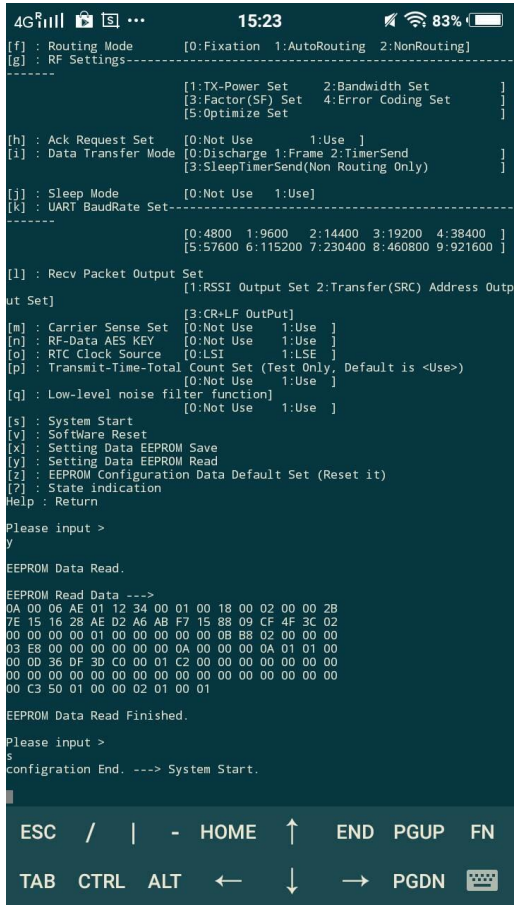
Resilient Regional Digital Signage: Warnings and alerts were displayed on the digital signage synchronously through NerveNet in Oct. 2016 at Asakusa, Tokyo.

Resilient Town/City Wi-Fi: NerveNet installed in Shirahama town have been providing public Wi-Fi service to tourists since May 2015.

Ad-hoc Network at Disaster Areas: NICT provided Internet connection using NerveNet and WINDS satellite mobile earth station in Kumamoto in April 2016 after the earthquake.

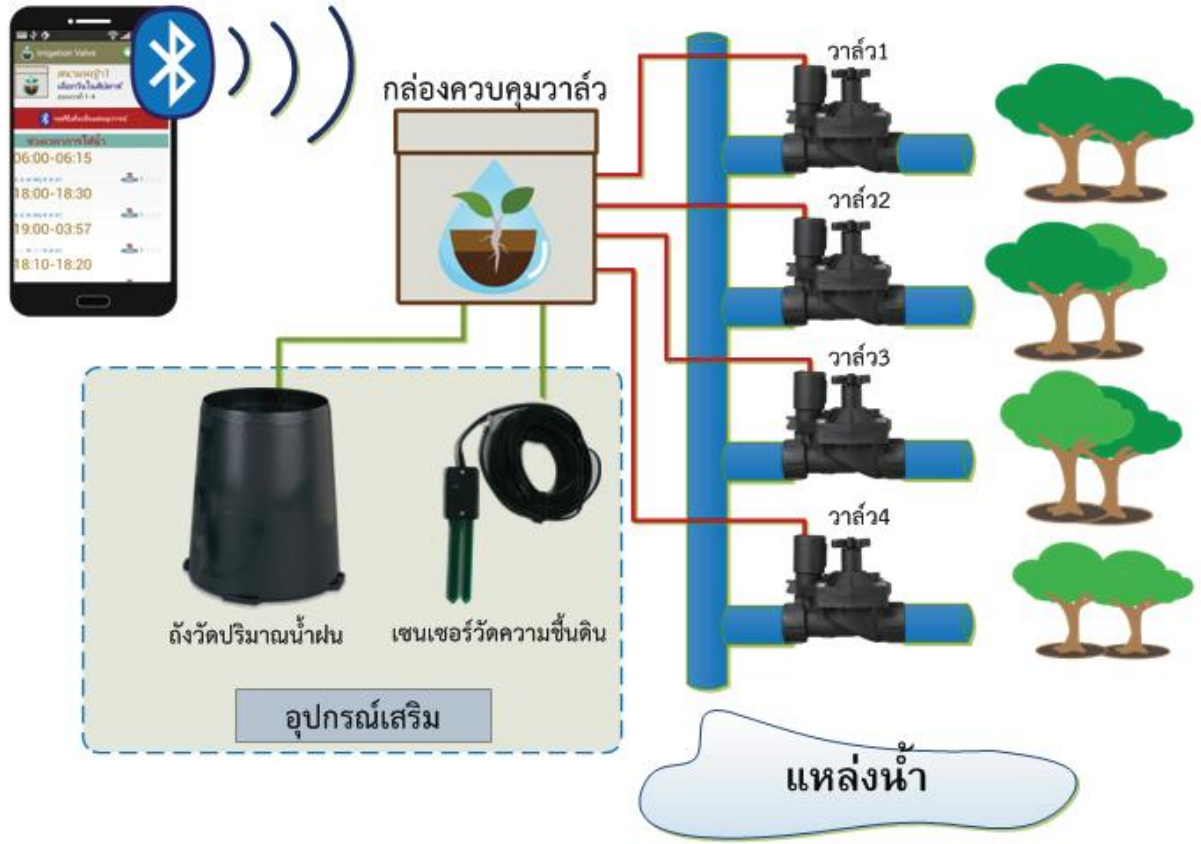
Smart Village in Rural Area: E-learning and Internet access have been provided to a Tele Center in Cambodia, through NerveNet with off-grid (solar-power only) system since March 2016.

Elementary experiment on the LoRa + NerveNet



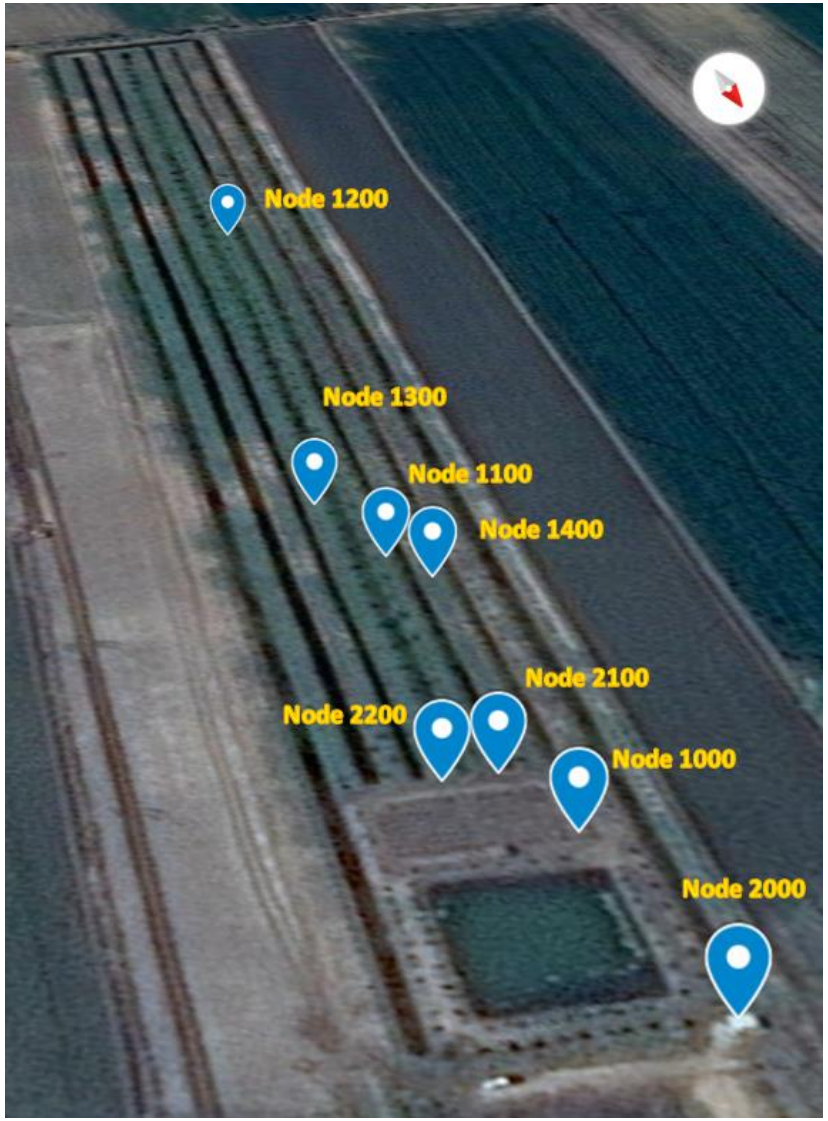
NECTEC's related project: Irrigation Valve Control Box

- 9-volt battery (1 year)
- 4-valve control, independently
- Timer setting/logging



NECTEC's related project: ระบบตรวจวัดและควบคุมสำหรับสวนมะพร้าวต้นแบบ (Watering System for Coconut Farming)

- Monitor the environmental parameters affecting the growth of coconut trees.
- Control irrigation valves.
- 4 types of nodes
  - Weather station node
  - Monitoring node
  - Valve control node
  - Central control node



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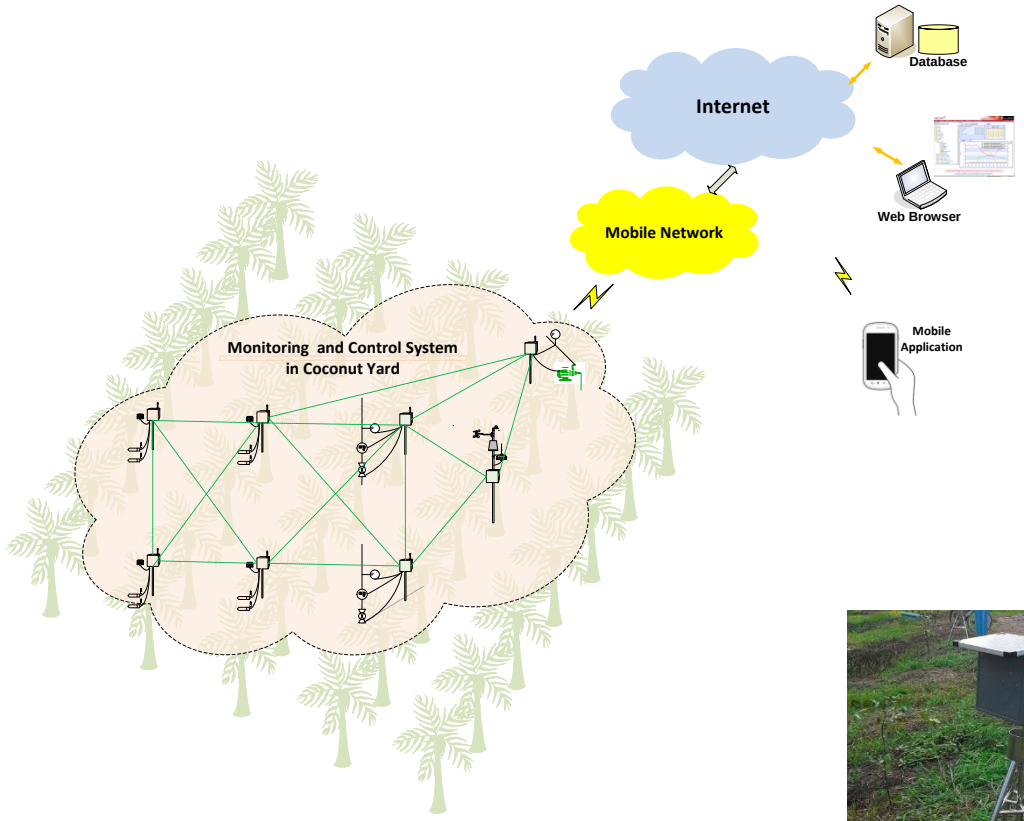

System Overview

Weather Station Node

Monitoring Node

Valve Control Node

Central Control Node