A Simulation Platform for IoT Smart Agriculture with LPWA Networks

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Background & Motivation

- With the rapid adoption of IoT for smart city , there has been increased interest in the use of IoT for agriculture to solve the challenges affecting productivity and food security.

Challenges in IoT Smart Agriculture Deployment

- Tedious in terms of the required resource allocation of IoT devices.
- Required components for maximum productivity and scalability.
- Conditions and constraints in the physical space on the farms are still not fully comprehended.

Research Questions

Towards our research goal , we seek to answer the following questions:-

- How can we optimize our resources in the deployment of IoT for smart agriculture?
- How much sensor nodes, gateways, cloud storage and data transmitted are required for a certain area to acquire a certain yield and productivity?
- Lastly, how to best design and create deployment strategies for Smart Agriculture in the real world?

Contribution

An **open-source platform** that:

- Seamlessly simulate IoT sensor devices for agriculture and integrate crop growth with accurate models.
- Provides results in terms of sensor network capacity, power consumption and farm sensed data.

Main Goal

To enable researchers to have a real field environment experience to measure certain components before implementation and deployment of smart sensors **towards higher yield, productivity and knowledge of soil/plant conditions.**

Methodology

To build our Smart Agriculture simulator , we integrate OMNeT++, a comprehensive network simulator, and AquaCrop-OS, a crop simulation model.

Input to OMNeT++ / AquaCrop	Output of Program
• No. of IoT sensor devices ; network parameters and scenarios. • Climate, crop, soil parameters, area of farm and field management	• Energy consumption, packet sent/dropped, correlation in network and sensed data from filed. • Crops response to climate change, attainable yields,

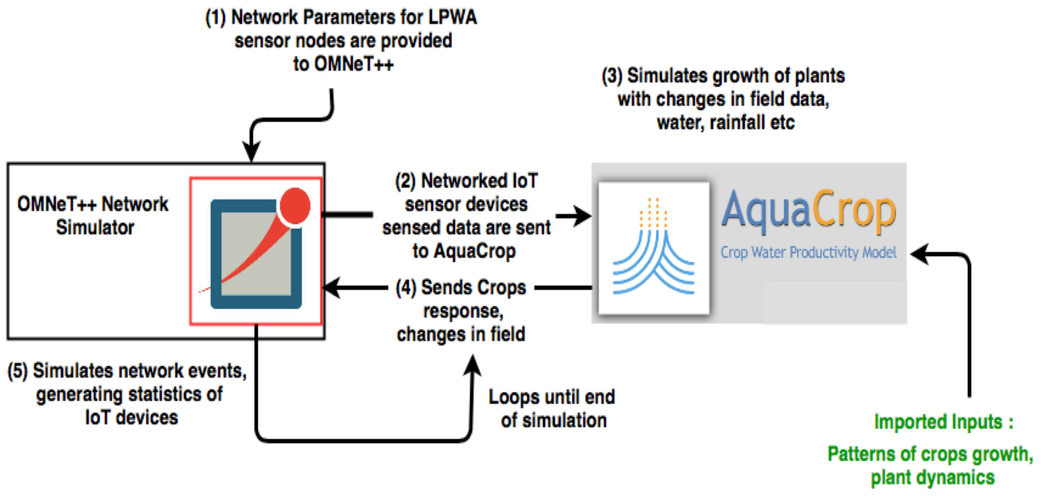

Figure 1: Smart Agriculture Flow Chart – Simulators Integration

Empirical Validation : Testbed

We setup a testbed using LoRa to validate the processes used in the simulator. It includes a logger application at the gateway and the MQTT Protocol to subscribe/publish data to IoT Server.

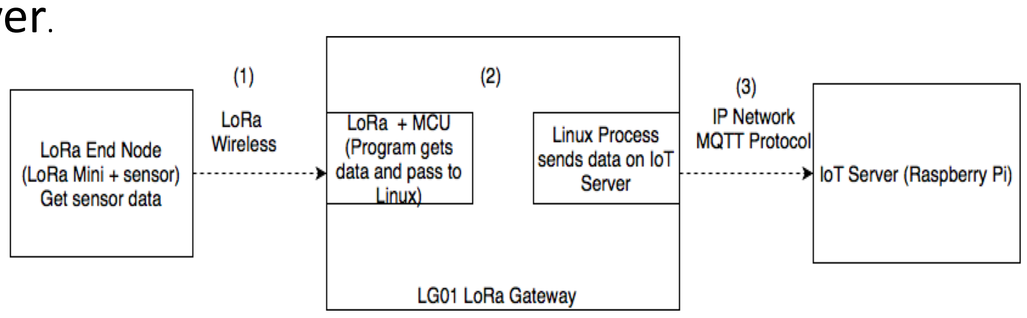

Figure 2: Data Flow of LoRa end nodes; LG01 LoRa Gateway; Raspberry Pi IoT server.

Future Work

Using the simulator, we seek to provide comprehensive **quantitative analysis of the smart agriculture simulator integration** in terms of:

- Different network topology based on LPWA; and Specialized for developing countries.
- Network : bandwidth utilization, packet data, node saturation and traffic patterns.
- Crop yield as a result of incorporating sensors.