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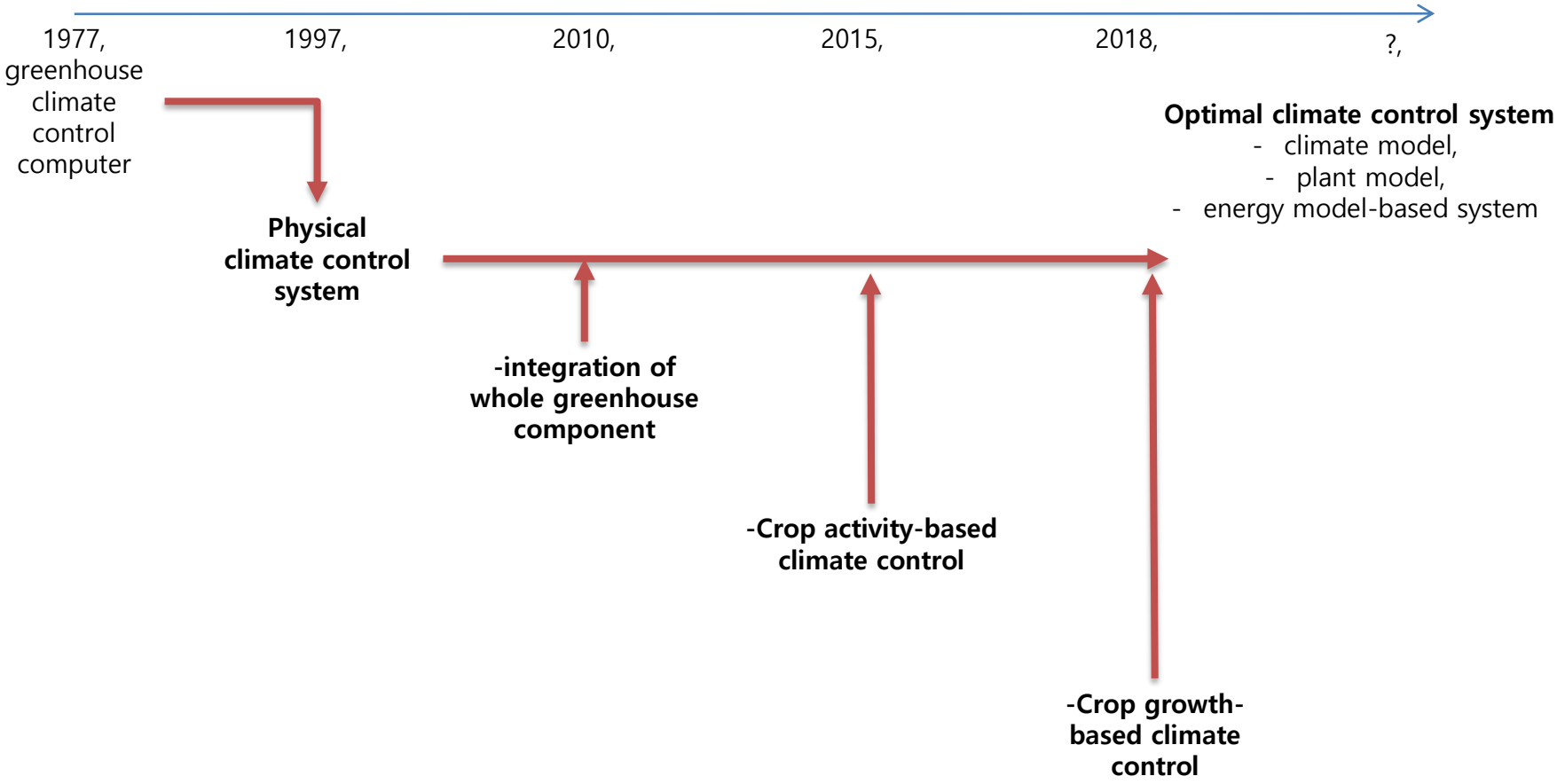
TECHNOLOGY.

KT GiGA Smart Farm

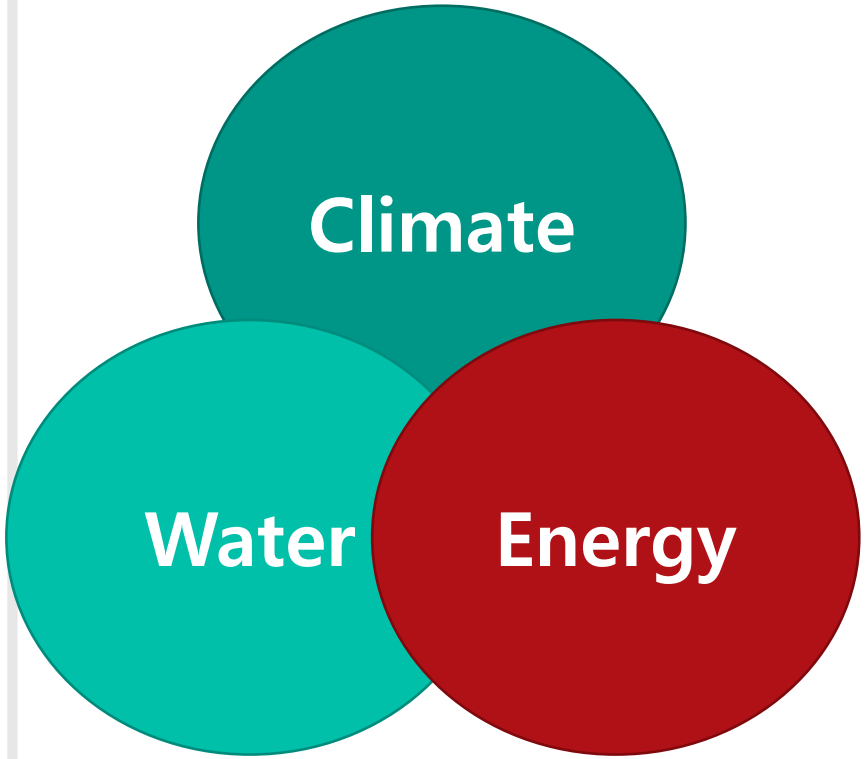
Configuration and Technologies of KT Smart Farm

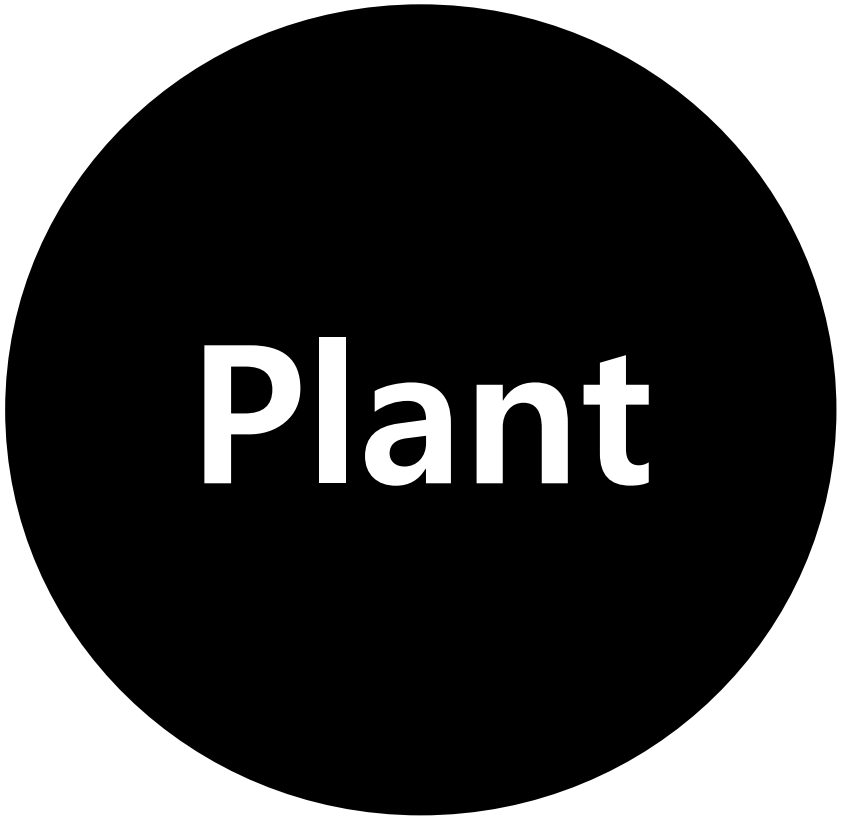
1-0 Control System in Green House



1-2 Control System in Green House

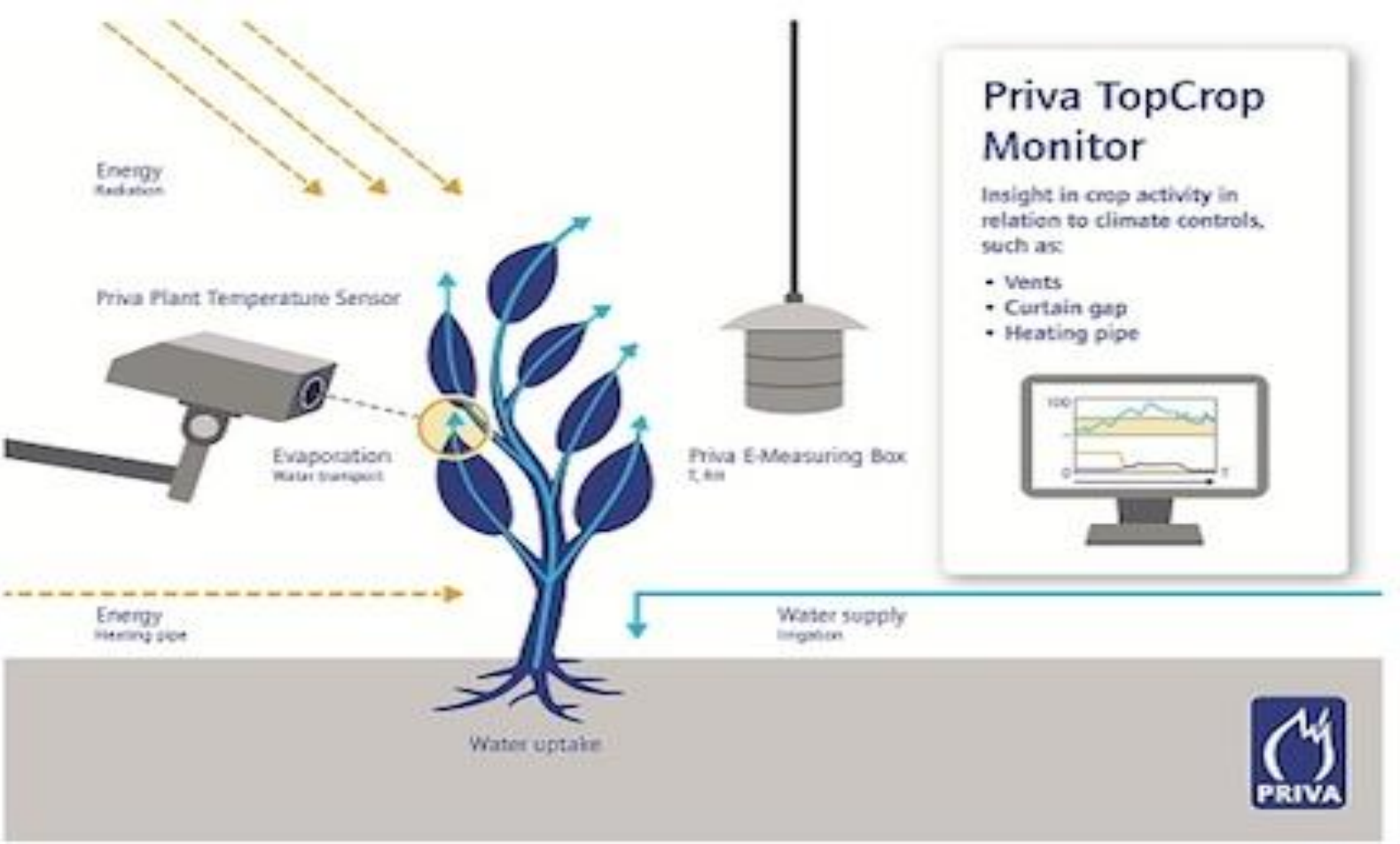
Physical climate control system-integration of whole greenhouse component



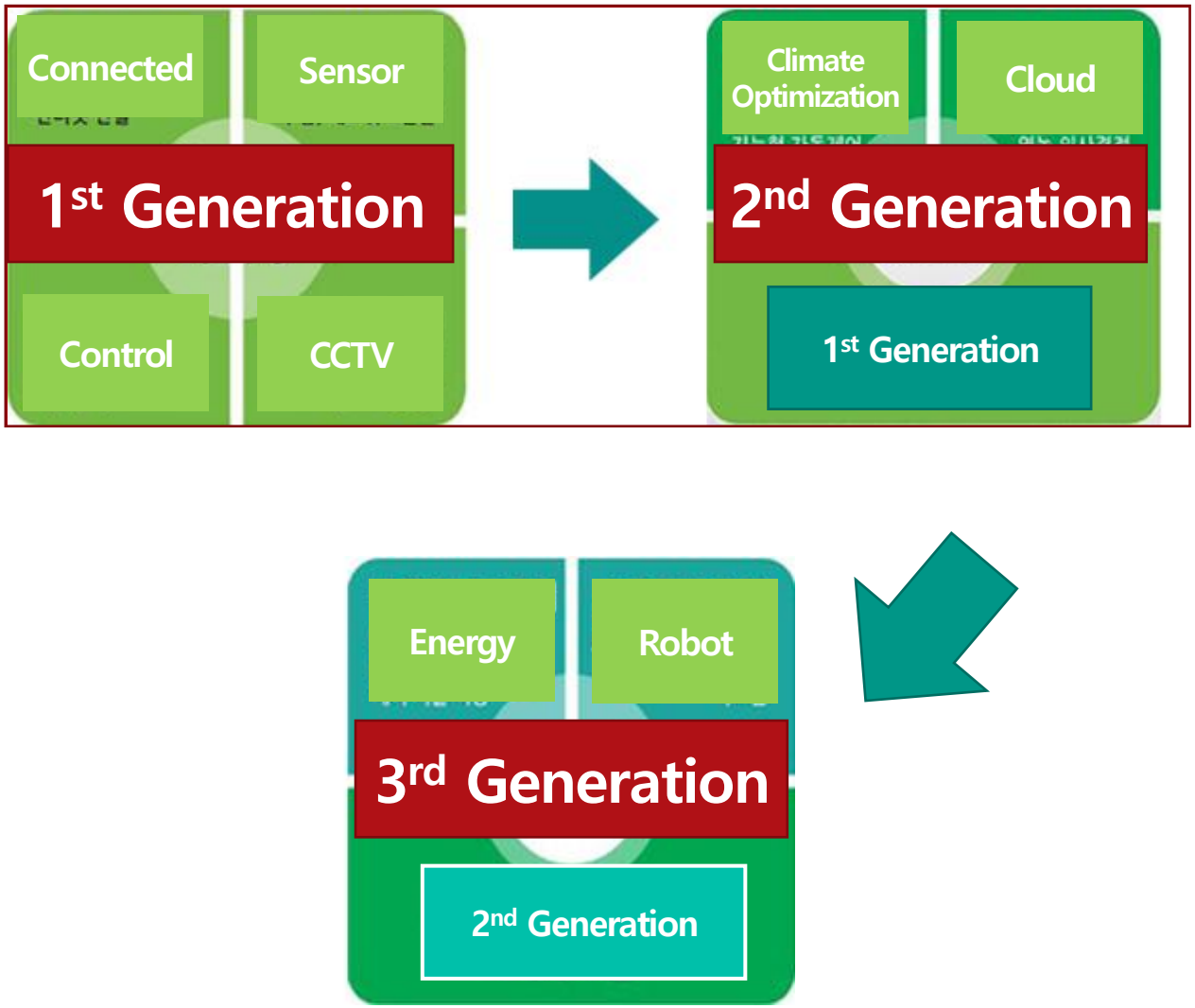


1-3 Control System in Green House

Physical climate control system
-integration of whole greenhouse component
-Crop activity-based climate control



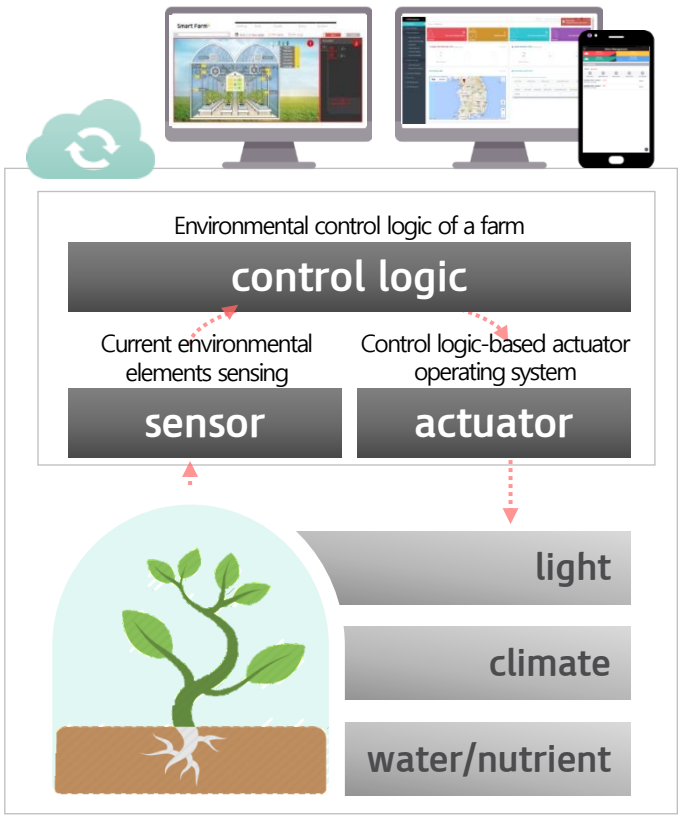
1-4 Smart Farm Specification in Korea



2 KT Smart Farm

Enhancing productivity through control of crop cultivation environment by utilizing ICT

KT's own design, independent sensors& devices, it can be expanded by adding modules



kt GiGA Smart Farm

Controller

- Utilizing Raspberry Pi(open source), RS485
- Reliable controller for adjusting device errors
- Actuator control logic based to create optimized environment

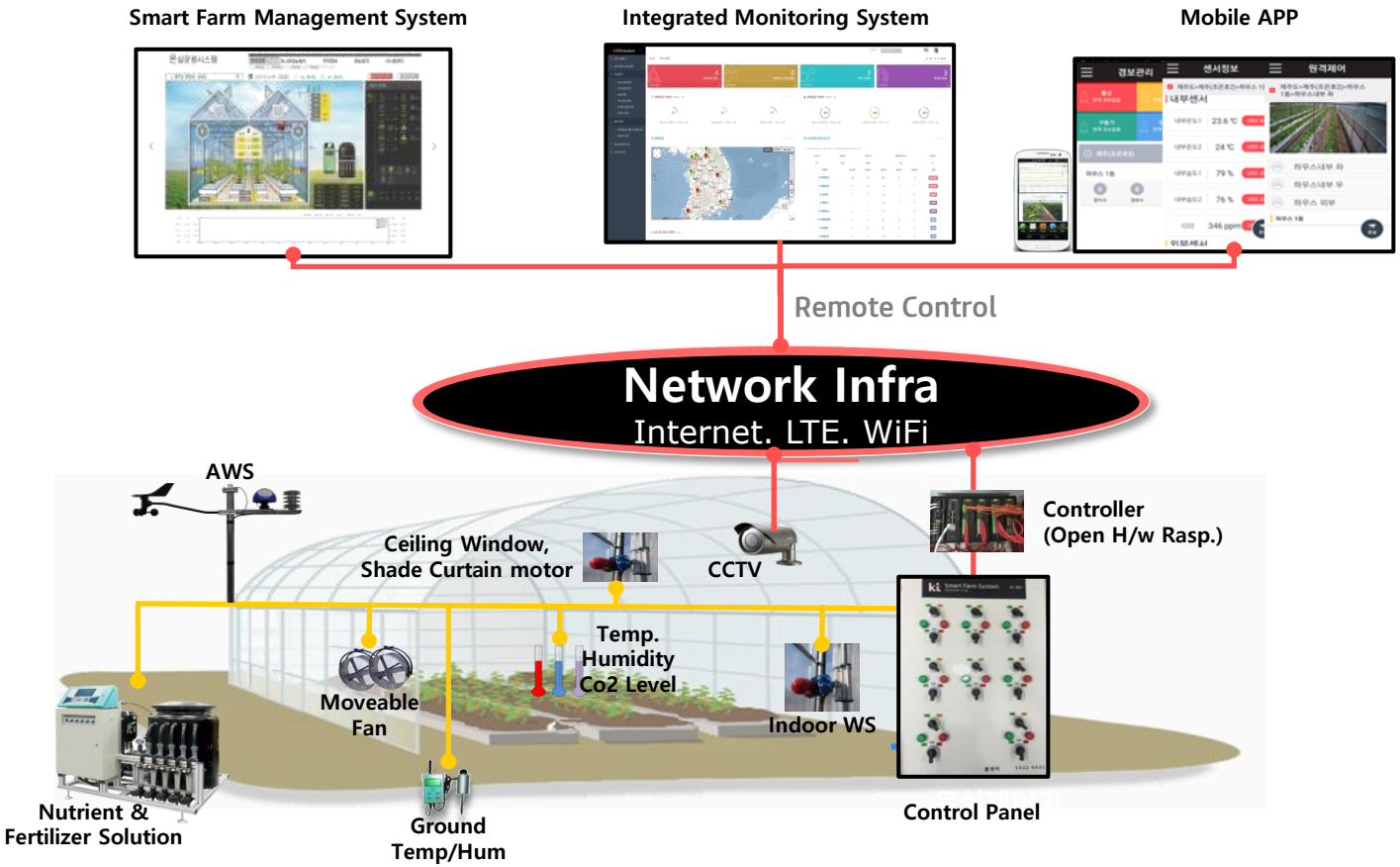
Platform

- Platform accommodate IOT devices using various sensors
- Central control system(cultivation environment, device errors)
- Precision environment control based on data analysis

IoT | Data intelligence | SW/HW

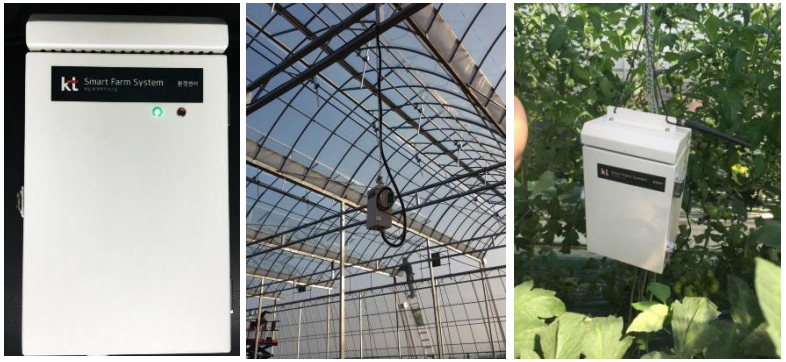
3 KT Smart Farm Configuration

Collecting& analyzing environment factors and providing proper cultivation environment through control device



3.1 Major Components of the Smart Farm

- **External weather service**
  - temperature sensor, humidity sensor, etc.



- **Internal sensor**
  - temperature/humidity/Co2 sensors for inside facility
  - temperature/humidity sensors for ground condition

- **Controller**
  - wire/wireless combined

- **Control panel**
  - magnetic switch, manual control

- **CCTV**
  - motion detection/moisture-proof

3.2 Smart Farm Types

Smart farm solution is implemented for various farm types

- **Greenhouse**

- **Open field**

- **Orchard**

- **Mushroom**

- **Vertical farming**

3.3 KT Smart Farm Components Details

- Main control points: environment and fertigation
- Actuators can vary by countries, farm types, etc.

System Component

Remote control

Controller

Environment Control ICT System

*fertigation system

Nutrient solution Supply System

Environment Sensors

- Inside sensor module
- Outside sensor module

Environ. Actuators

- ventil. fan/window
- shade curtain
- cooler/heater
- sprinkler
- supplementary light

Nutrient Sensors

- nutrient tank
- bed

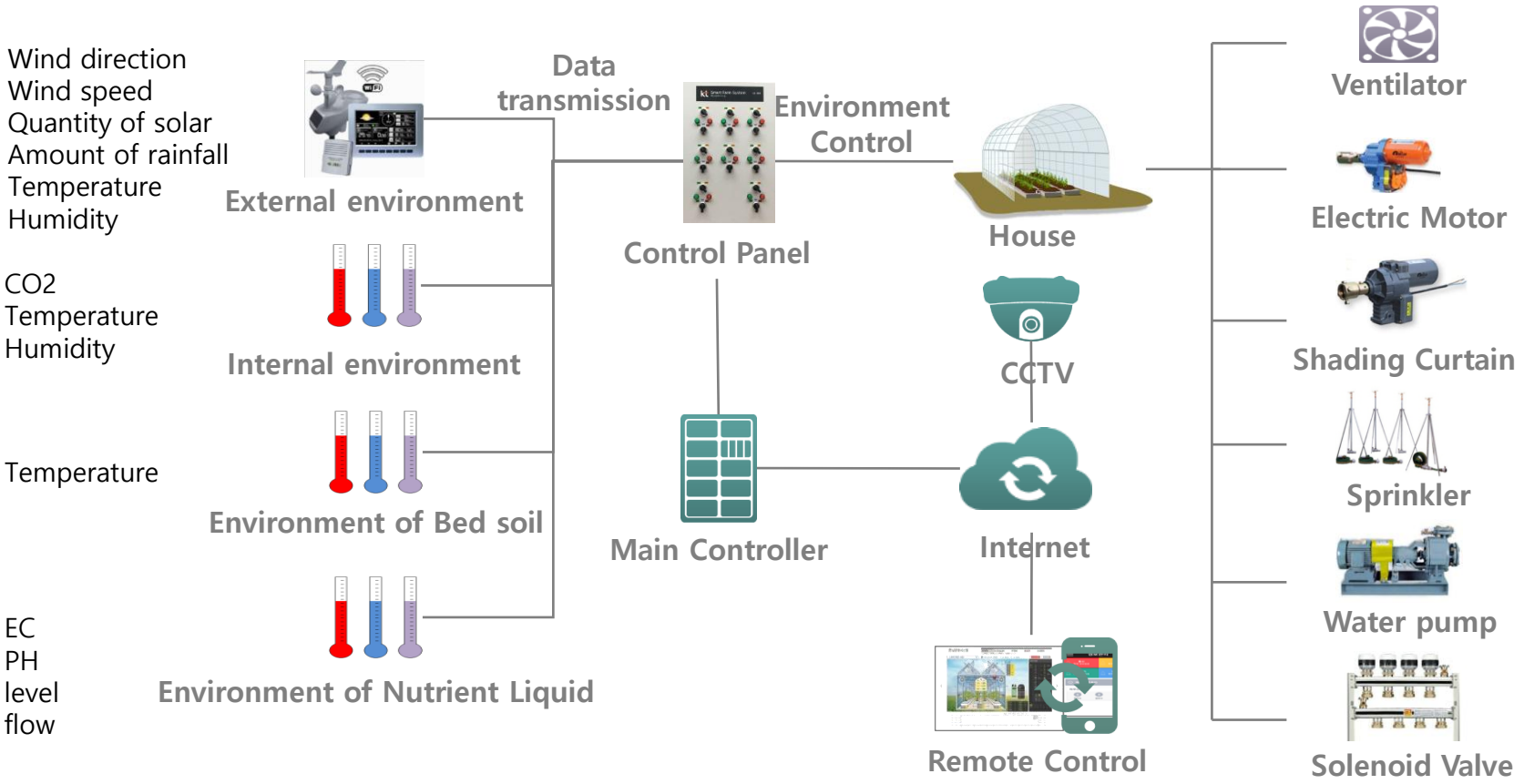
Nutrient Actuators

- dosing system
- supplying pump/valve

3.3 KT Smart Farm Components Details (cont.)

KT Smart Farm Platform accommodates various sensors and actuators
*open platform

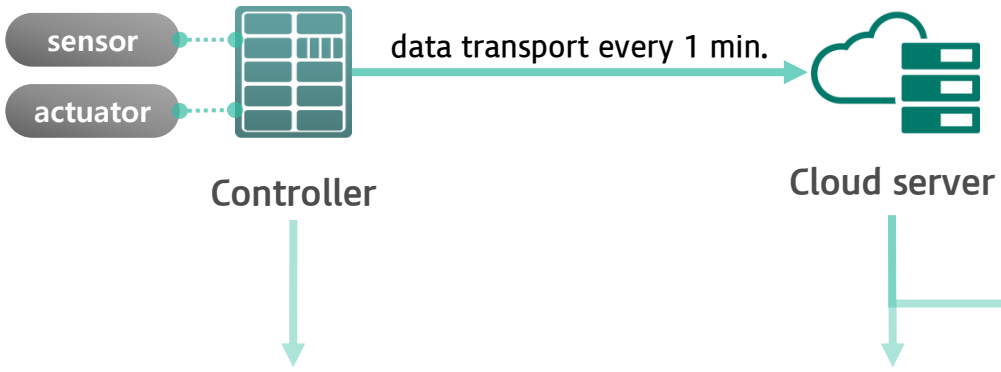
System Component



4.0 ICT Solutions for KT Smart Farm

Controller installed in the control panel collects sensor data and operate actuators

There's data transport every 1 minute from controller to server



(Reference)

Korea

- Operating control servers in Gwang-ju IDC(~'18)
- Operating cloud servers('19~)

Abroad

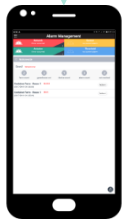
- Possible to implement Built-in server(UAE case)
- FAO may operate its own cloud/server

Smart Farm Management System

- Real-time sensor value, actuator status
- Manual Control
- Auto Control Setting

Integrated Monitoring System

- Error Alarms
- Statistical Data
- CCTV
- Manual Control



Smart Farm Mobile APP

- Error Alarms
- Sensor Value + quick graph
- CCTV
- Manual Control

4.1 Smart Farm Management System

Real-time monitoring and automatic environment control for individual farm

Real-time sensor data and operation monitoring

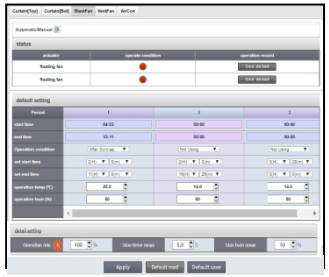
INSIDE SENSORS
- Temperature
- Relative humidity
- CO2 concentration
- Water temperature

OUTSIDE SENSORS
- Temperature
- Relative humidity
- Rain detect
- Solar radiation

Operating Status

Red	Manual mode on panel or Device error
Green	Closing / Opening / On
Grey	Stop / Off

Auto control settings

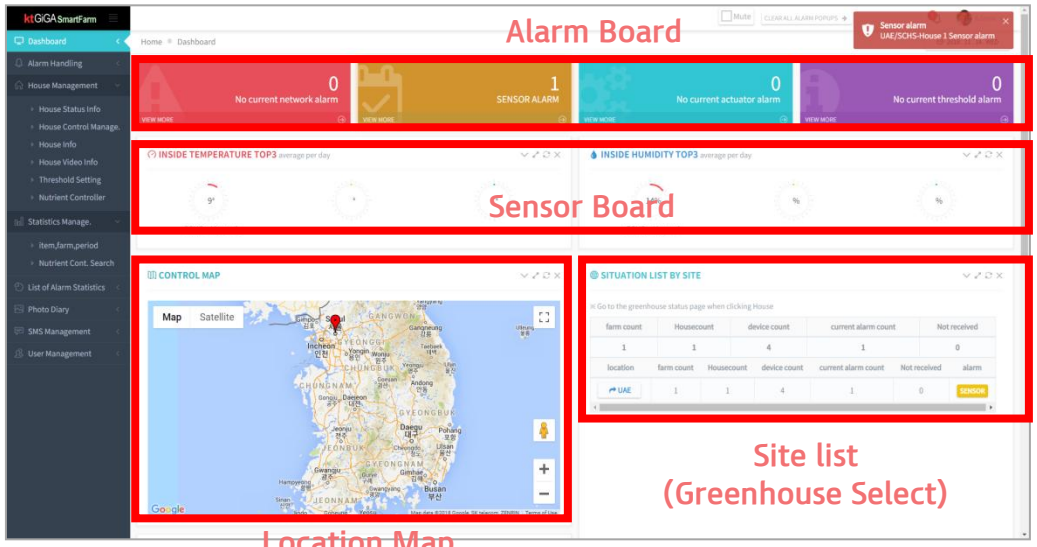


Automatic control of ICT solution brings desired environment for crops

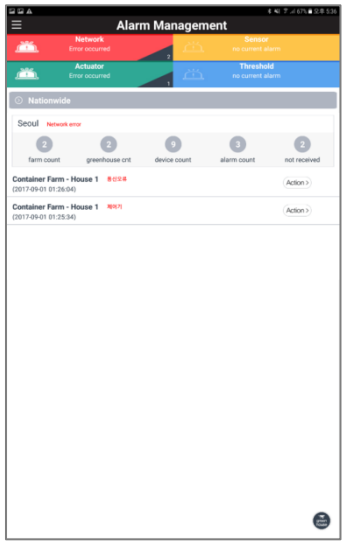
4.2 Integrated Monitoring System (Web/App)

Main purpose of the Integrated Monitoring System is to manage multiple smart farms across country

WEB



APP



Error Reports

Network Alarm
- Control panel down
- Internet connection failure

Actuator Alarm
- actuator breakdown

Sensor Alarm
- sensor module failure
(unstable signal / sensor breakdown)

Threshold Alarm
- undesired greenhouse condition
- notifies when sensor value is out of range

4.2 Integrated Monitoring System (Web/App) _ Cont.

Main purpose of the Integrated Monitoring System is to manage multiple greenhouses across country

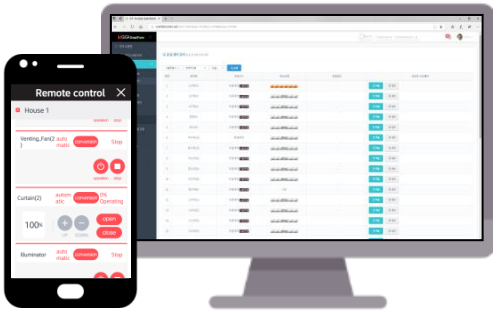
Monitoring

Current environment condition
with 24hr graphs

CCTV

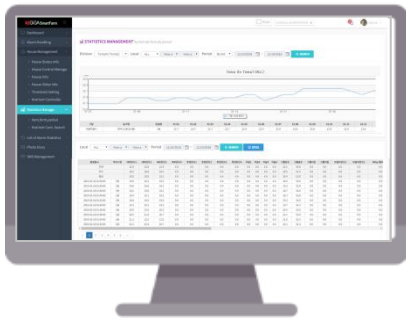
Real-time CCTV and stored
video with motion detection

Manual Control



Manual control of actuators
in case of emergency

Statistical Data



Provides raw data, daily/hourly
average data and graphs

4.3 Optimum proportional control model for ventilation& heater model

Detailed environment control system based on machine learning and customized control for different greenhouses

[Ventilation model and Heater model]

1

Historical Data based Greenhouse Ventilation and Heating Optimization Modeling

Operational SmartFarmDB

Historical Data

System Dynamics Model

Greenhouse dynamics Modeling

Greenhouse Environment data

Learning

Conclusion of dynamics

New external Factors Transition of dynamics

Artificial Intelligence Model

Greenhouse I/O Modeling

Greenhouse Environment data

Learning

Artificial neural network model

Black Box Model

[Green House Modeling]

[Modeling & Optimum Parameter Set]

Region/Crop/Season Model & Parameter

GH Profile

Multi-span tomato greenhouse

Multi-span tomato/strawberry greenhouse

Multi-span strawberry greenhouse

GH Model set

Optimum Parameter set

2

Modeling based Simulation

Optimization Parameter

P-band

Wind Speed

Integ. Temp.

Etc..

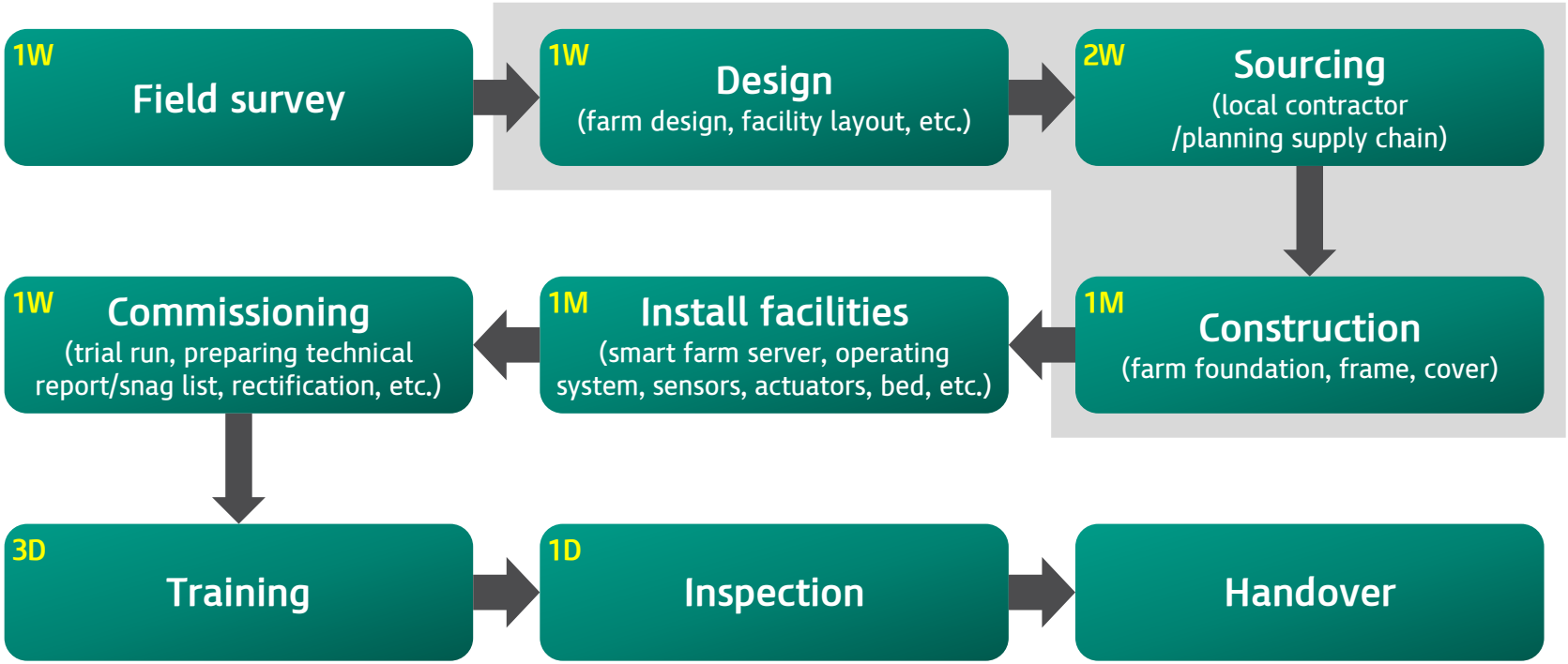
SF Management System

5. Smart farm implementation steps

Expected implementation period is approximately 3.5 months

However, it could be varied depending on the size and circumstances of the farms.

KT follows a world standard of smart farm construction, which is accepted as a general rule, as follows :



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