# Introduction to IoTtalk


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NCTU

# The Evolution of Communication

H2H → H2M → M2M

A humans talks to the other humans.

The human talks to the other humans.

A human directly controls the machines.

The human manipulates the machine himself.

A machine automatically controls the other machines.

Machines have logic or intelligence to manipulate other machines. That is, IoT devices can talk to each other (**IoTtalk**).

## Why IoT Industry does not fly?

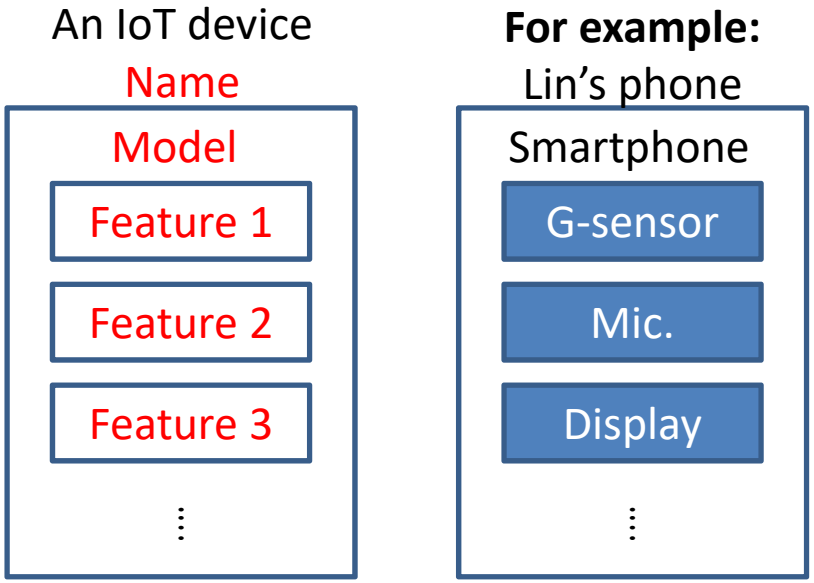
1. Too many complicated standards that are difficult to interoperate
2. Most IoT devices only talk to few “other” IoT devices
3. Most IoT applications are difficult to maintain
4. Only developers can play the games, the users are unlikely to participate (automatic home vs smart home)

## A Possible Solution

1. To modulize the IoT development platform
2. To provide “local” intelligence at the IoT device’s side (Edged Computed AI)

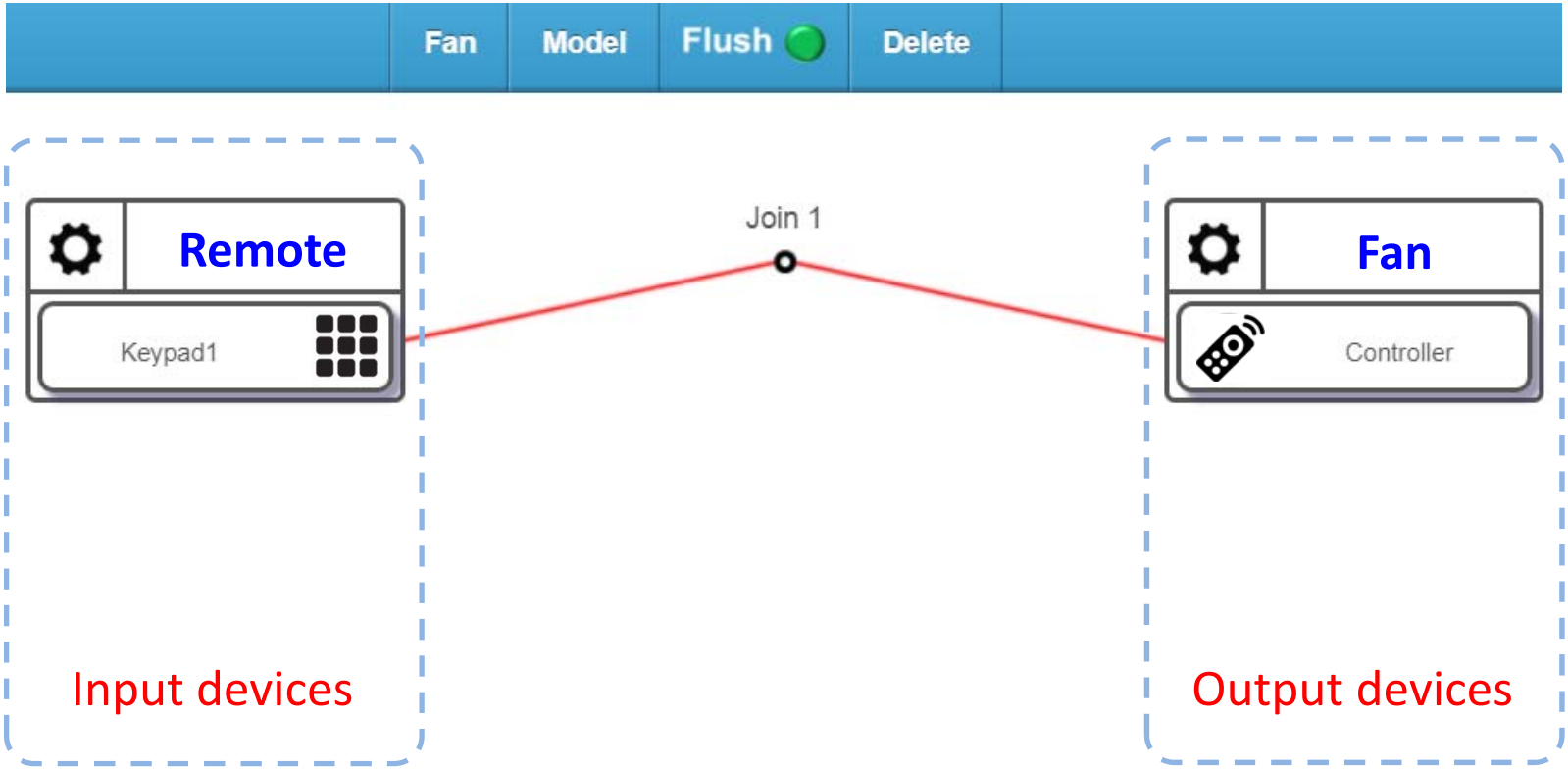
# What is IoTtalk?

- **IoTtalk is an IoT device management tool**
- **IoT management concept**
  - Device Feature
    - The function or capability which an IoT can provide
  - Device Model
    - A set of device features
    - A device model refers to a specific product
  - Device name
    - The name of a specific product



# Why is IoTtalk?

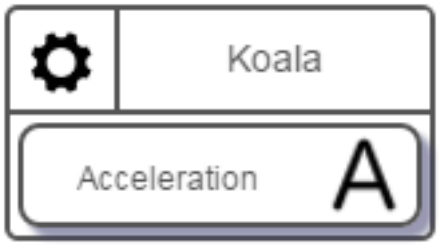
- **Applications can simply develop with lower efforts**
- **Simple and intuitive GUI**
- **Application development without real devices is feasible**

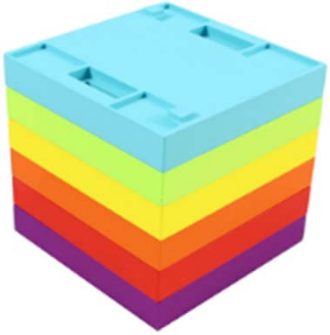


# Applications can simply develop with lower efforts

- Reusable DF modules
  - Even they are different IoT devices





# Easy to Deploy and Operate


Intel Edison

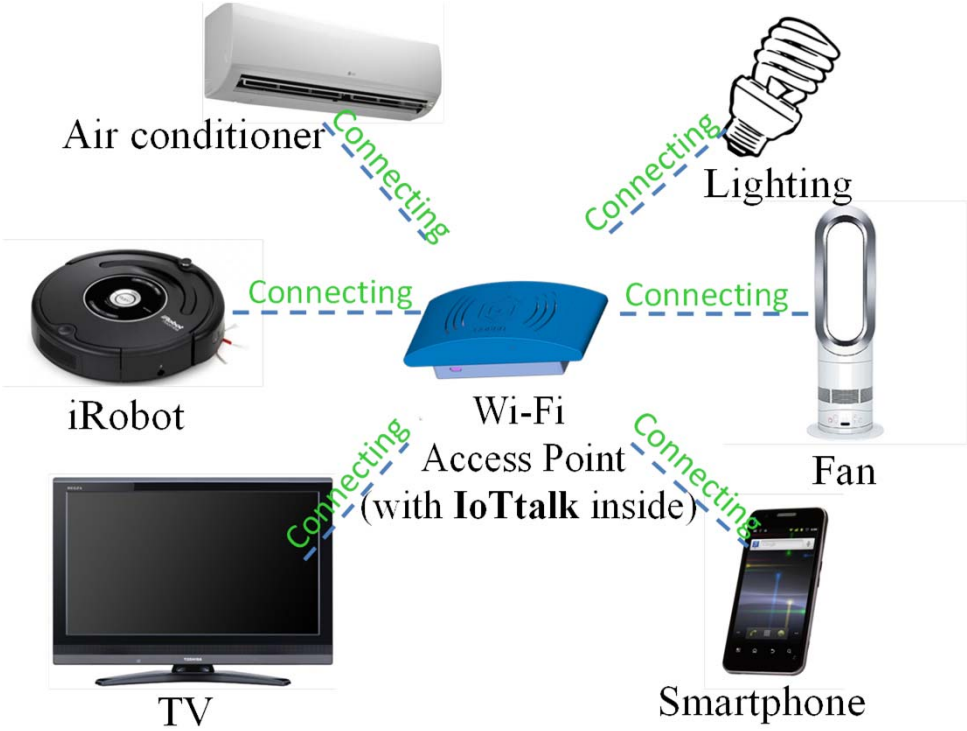
Raspberry Pi3

PC server

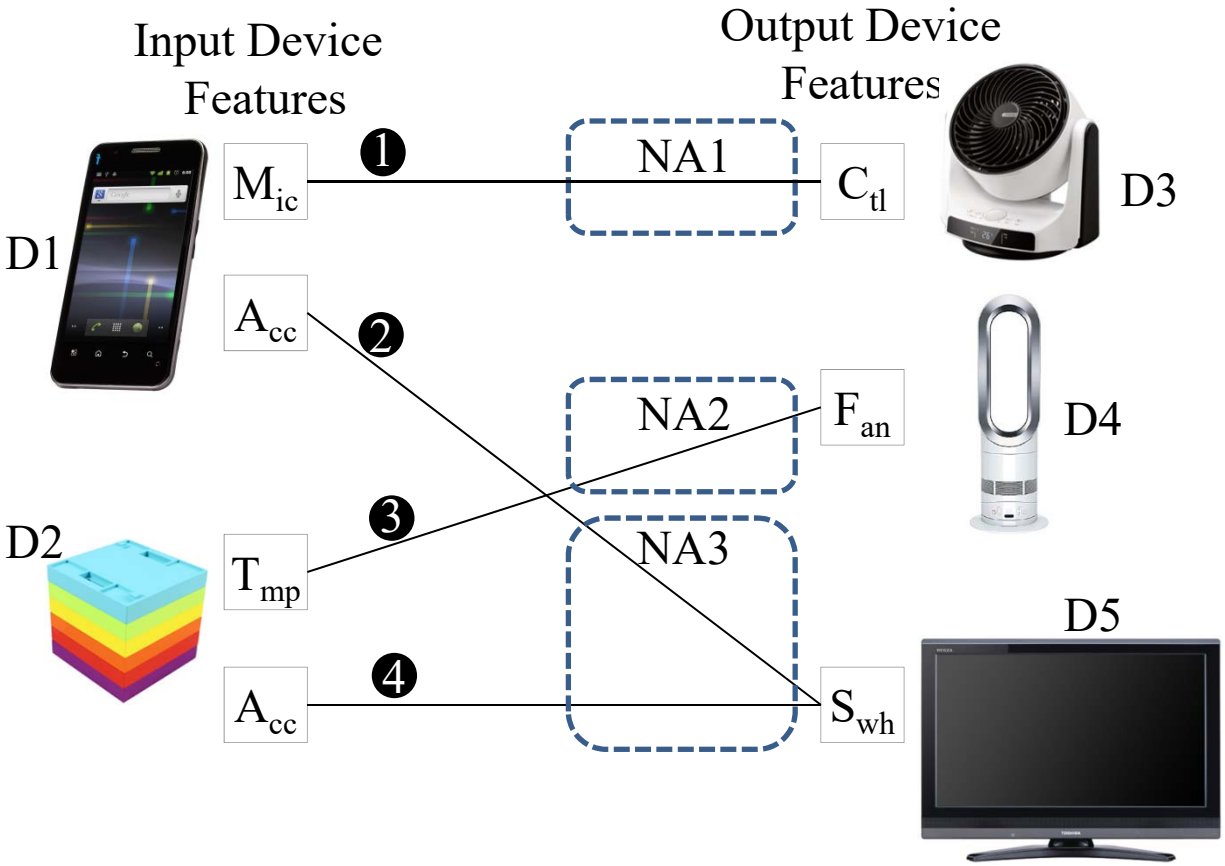

For example, you can try
http://140.113.199.200:7788/connection

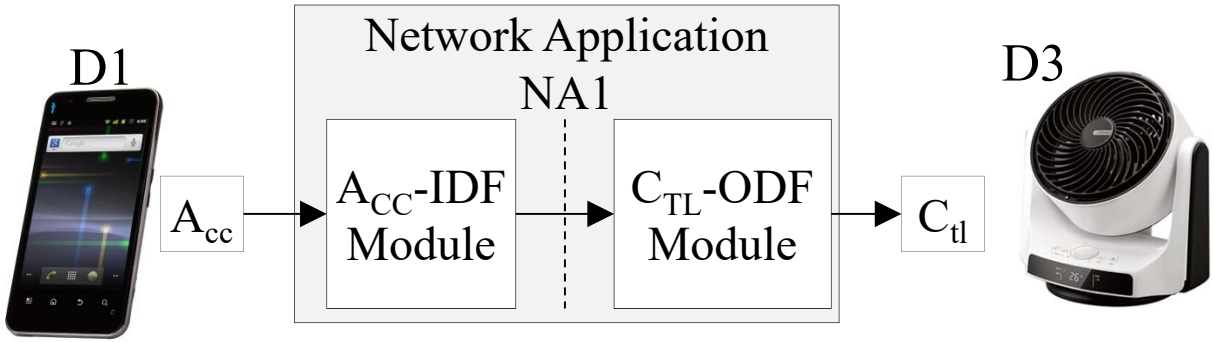
# GobitTalk


GorbitTalk 快速安裝手冊
GORBIT

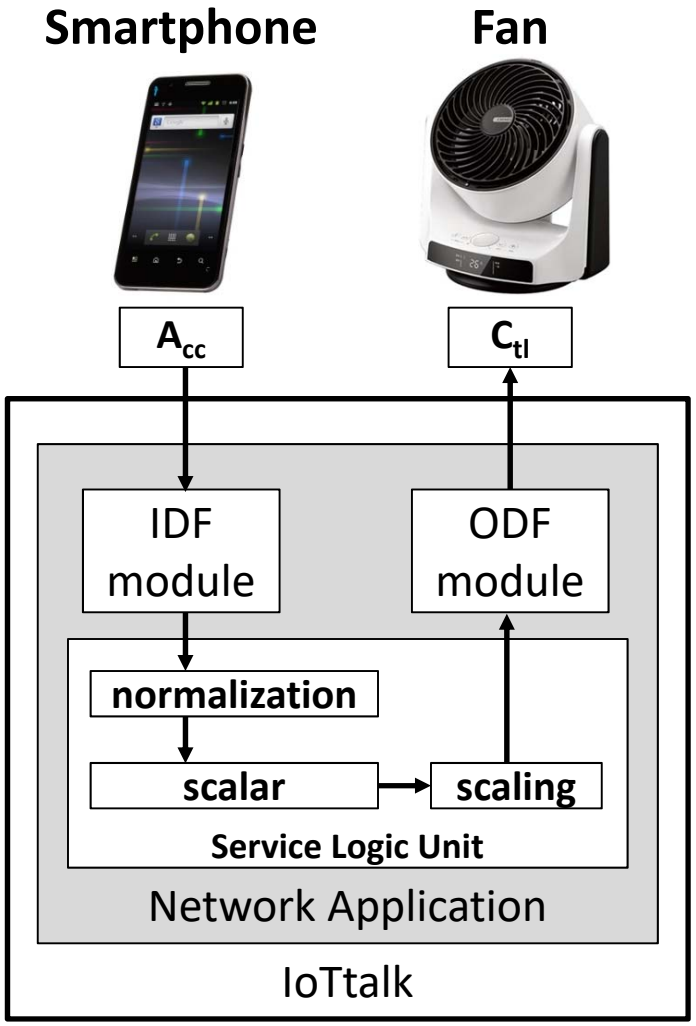

Air conditioner
Connecting
Lighting
Connecting
iRobot
Connecting
Wi-Fi
Access Point
(with **IoTtalk** inside)
Connecting
Fan
Connecting
TV
Connecting
Smartphone

# Appliance Connections with IoTtalk

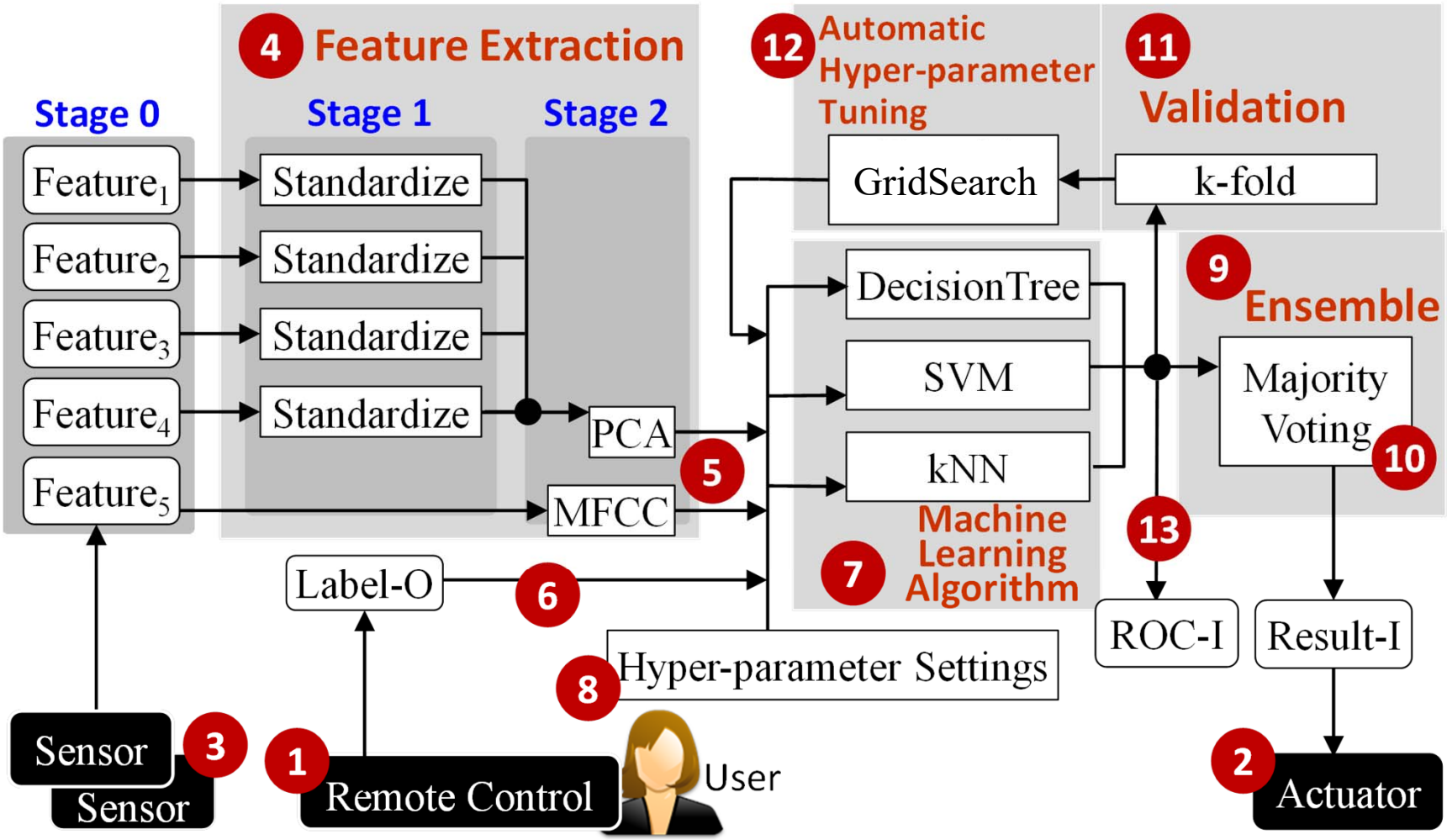


# Connection and Mapping Manner

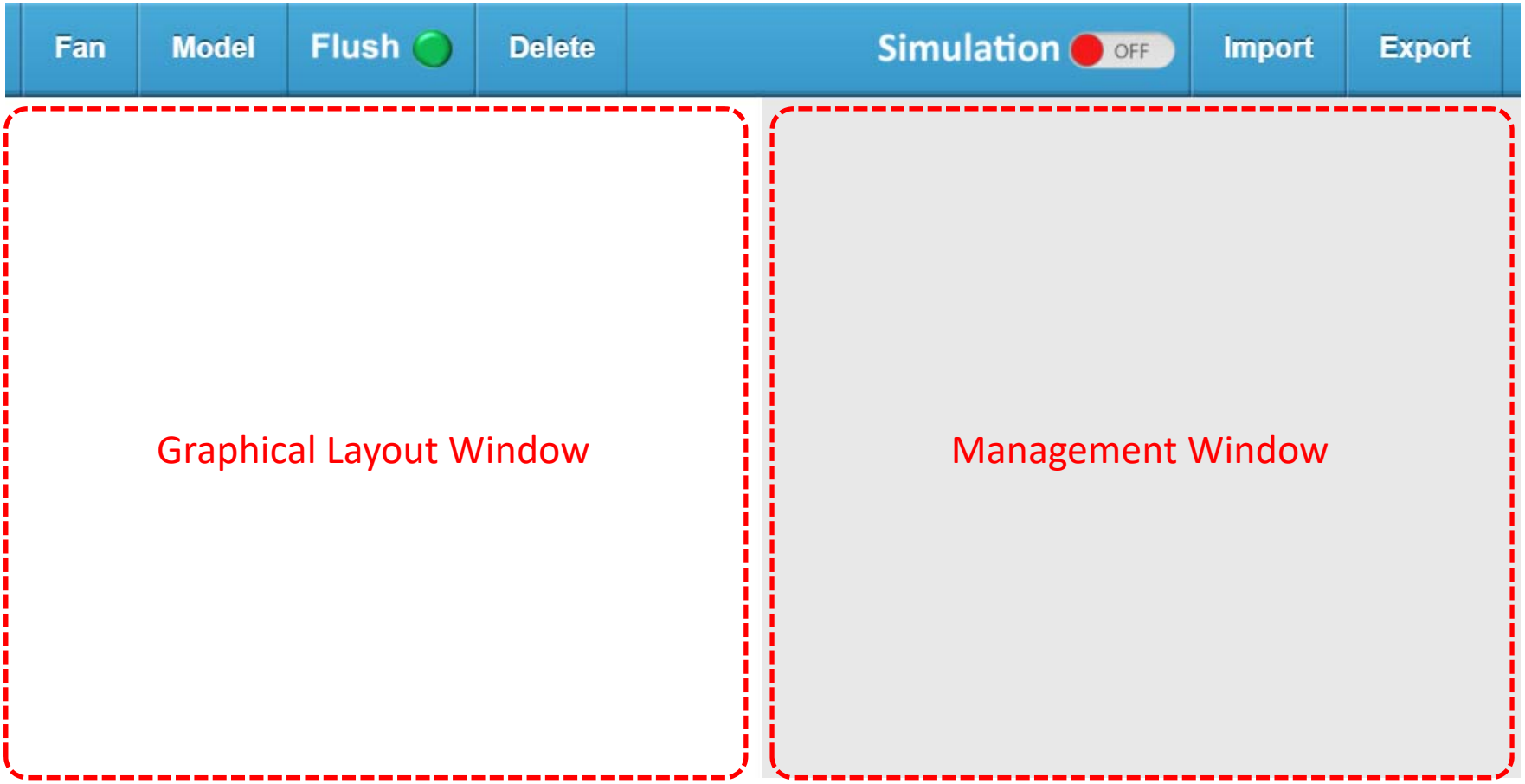


# AItalk: IoTtalk with Machine Learning



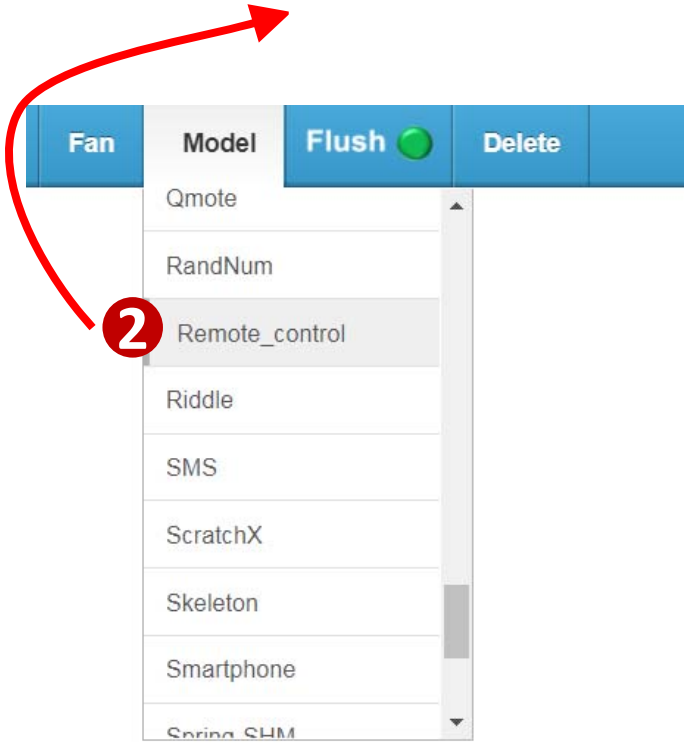
# The IoTtalk GUI

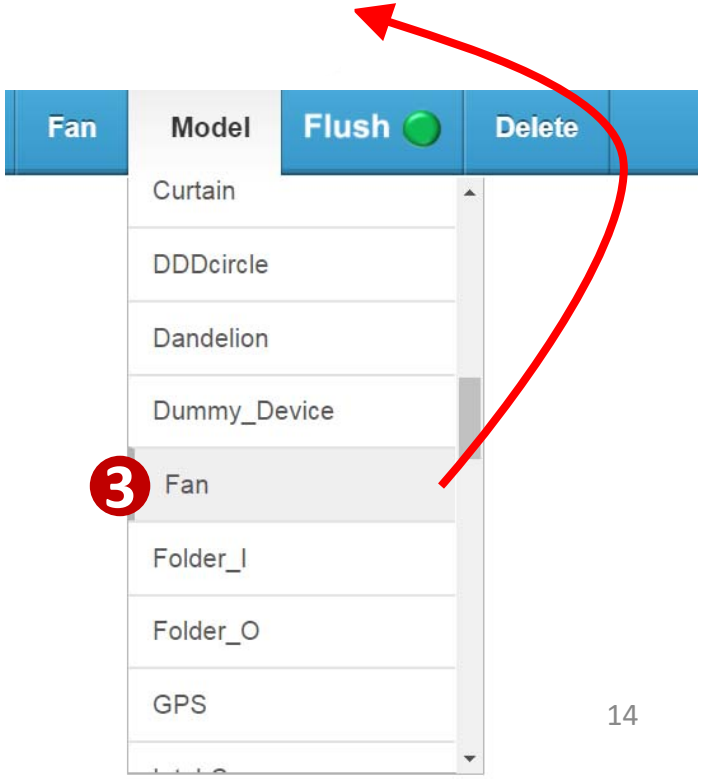
- Create a Project “Fan”



# Device Model Selection

- The user selects device models from the “Model” drop-down list.

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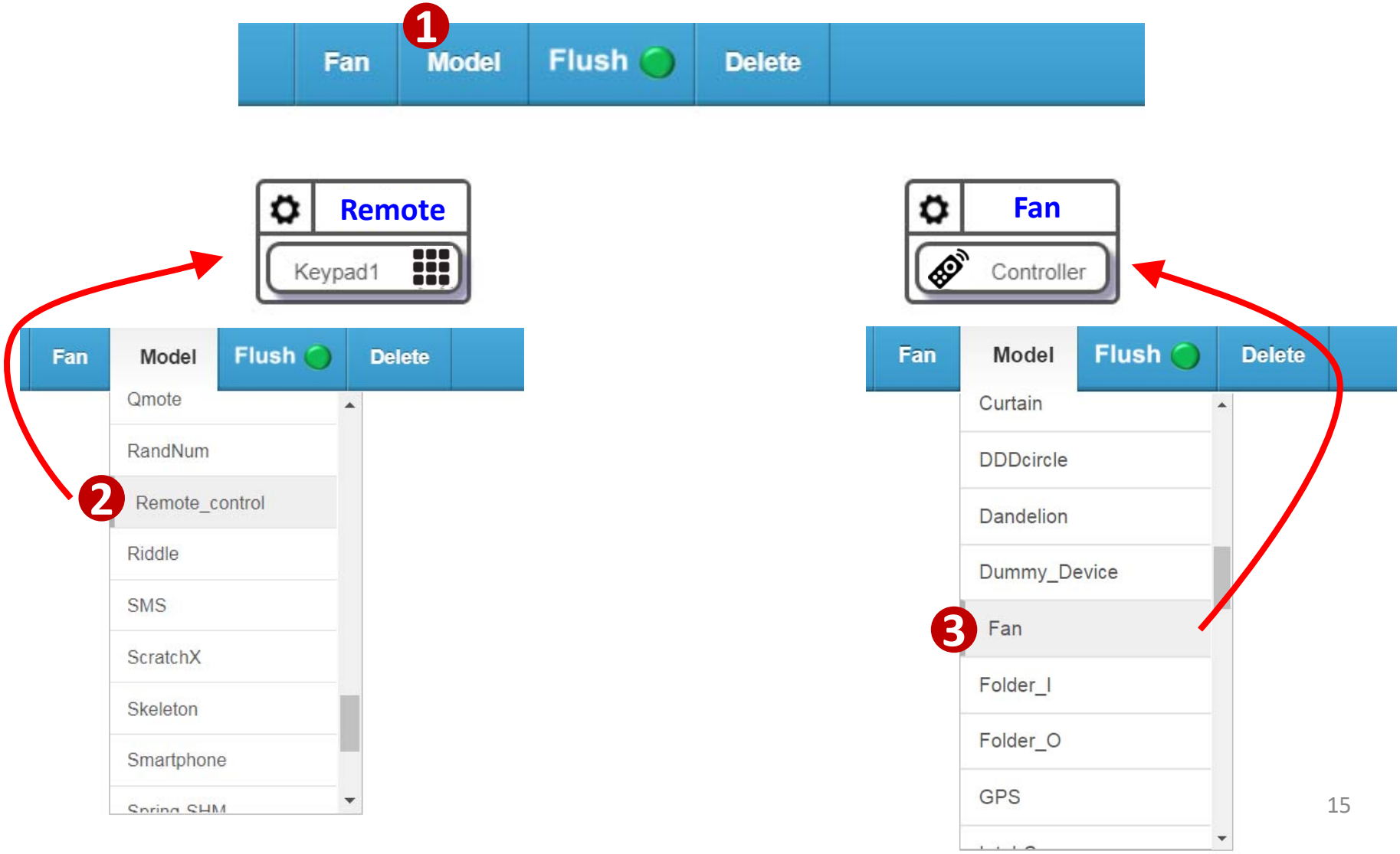
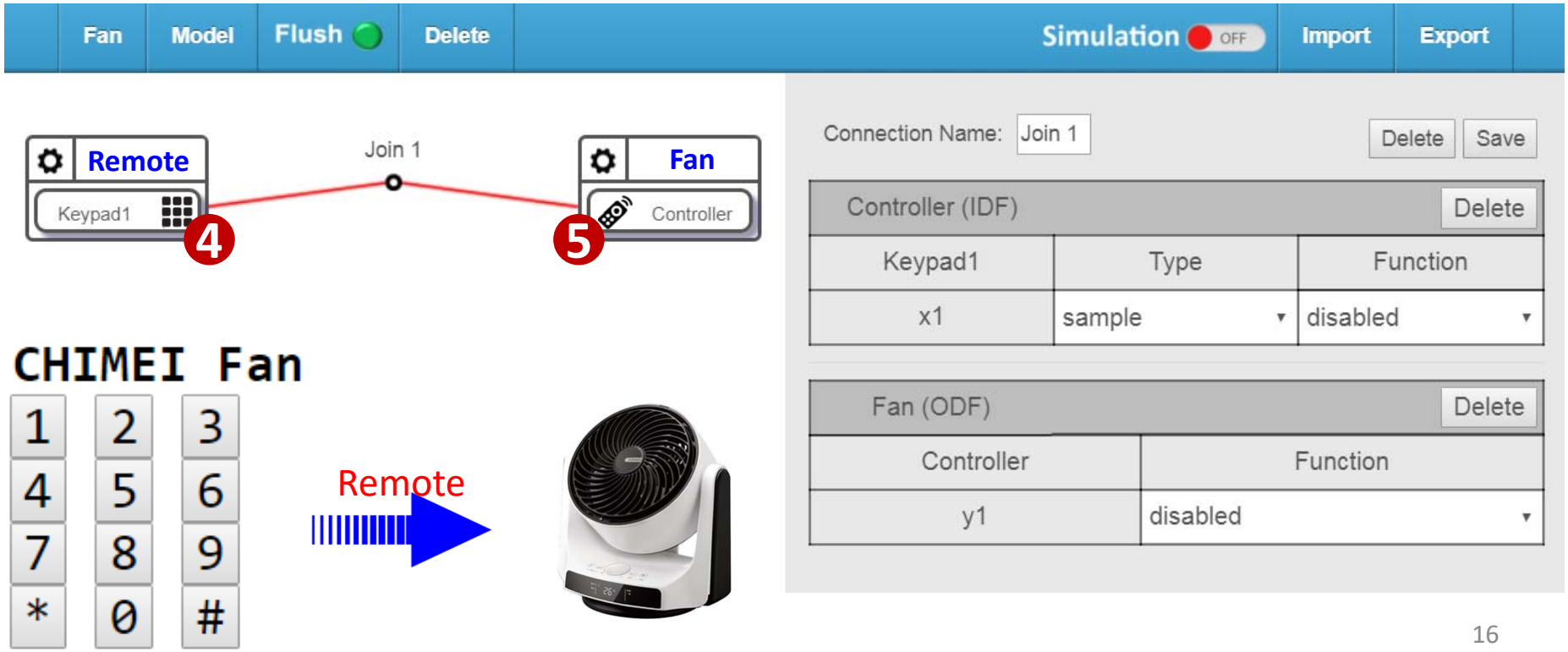


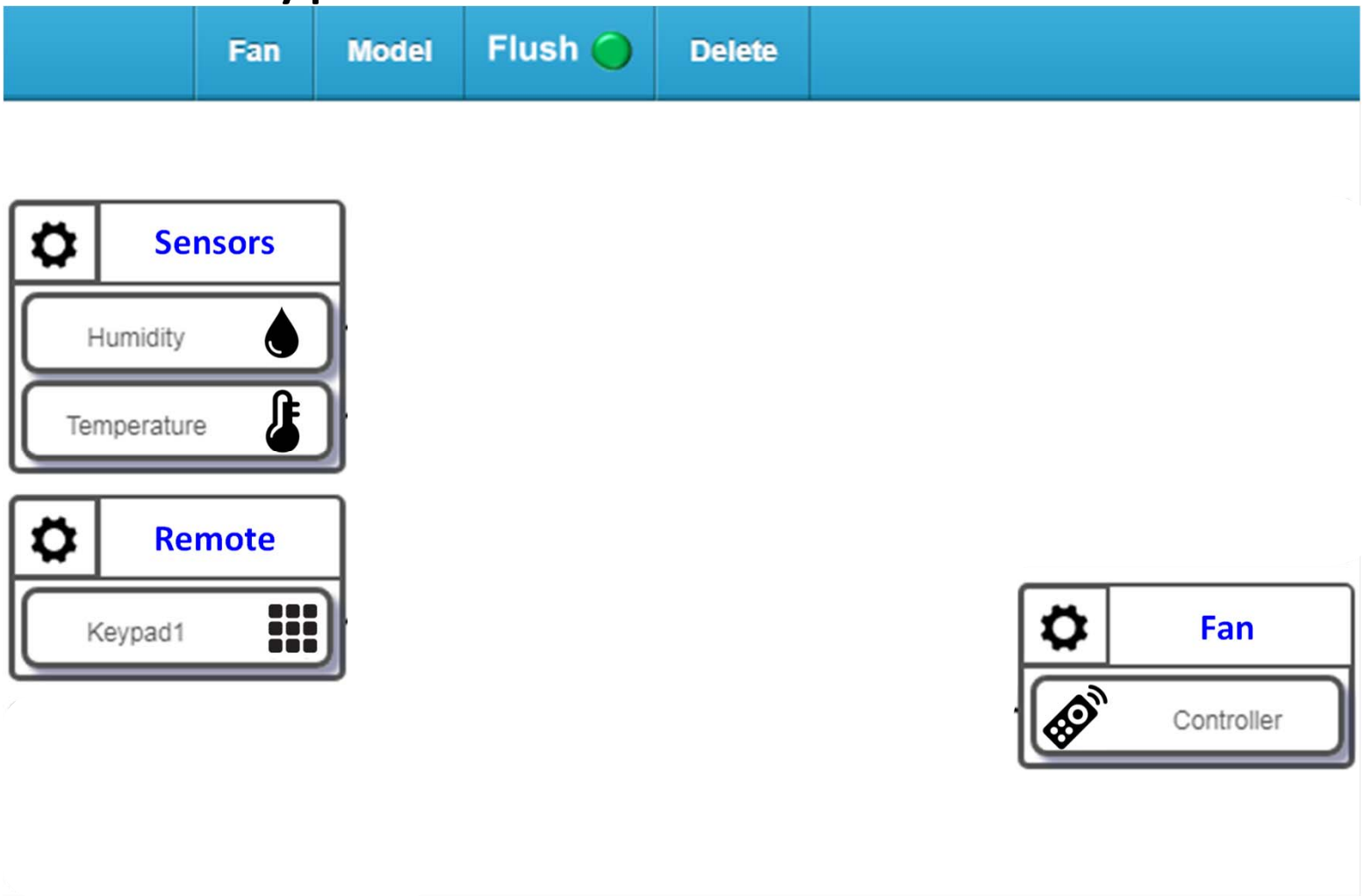
# Fan Control using IoTtalk

- Click the device features of the two devices to create a link between them.
- Then, the user controls the Fan using Keypad through IoTtalk



# Smart Fan using IoTtalk with Machine Learning

- Insert a machine learning device and sensors between Keypad and Fan.



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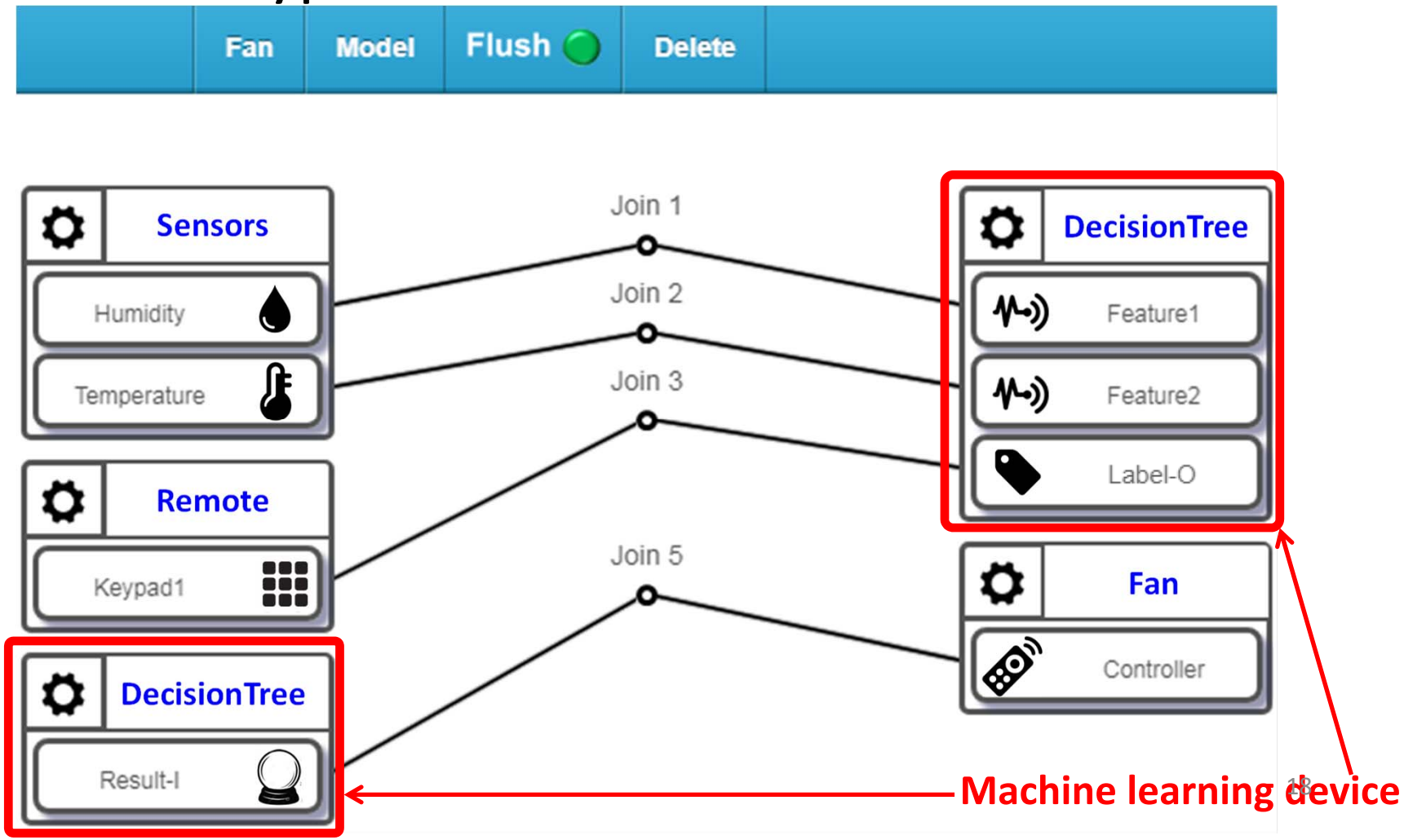
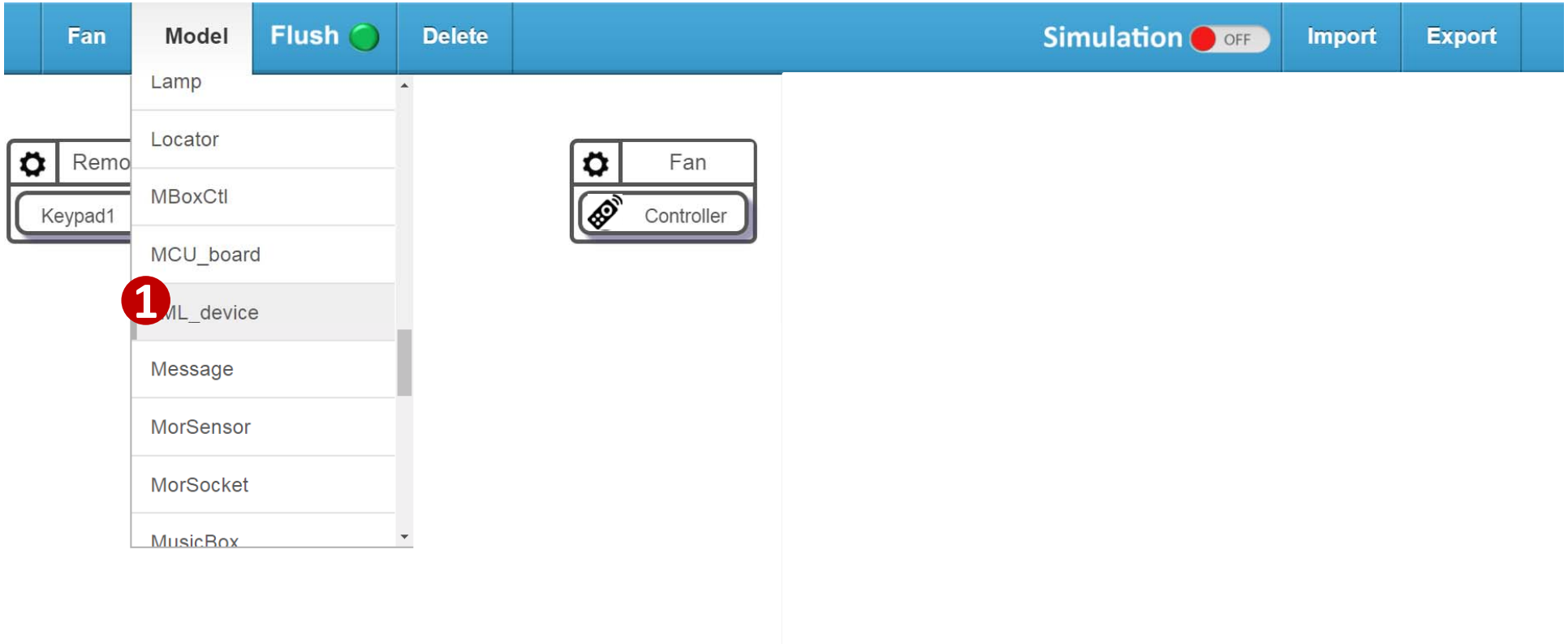


# Add a Machine Learning Device

1. Select “ML_device” from the Model menu
2. Select the number of “Feature” for ML_device
3. Click “Save” to add the machine learning device



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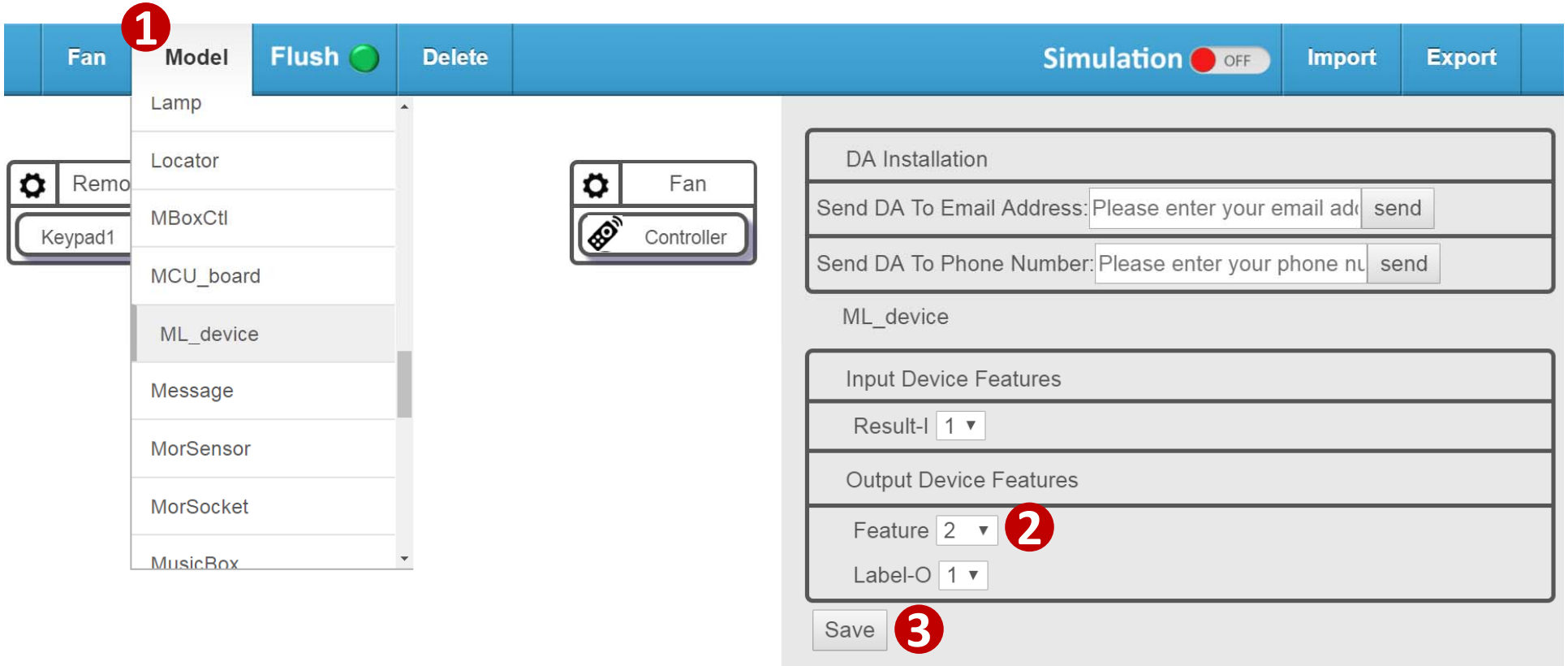
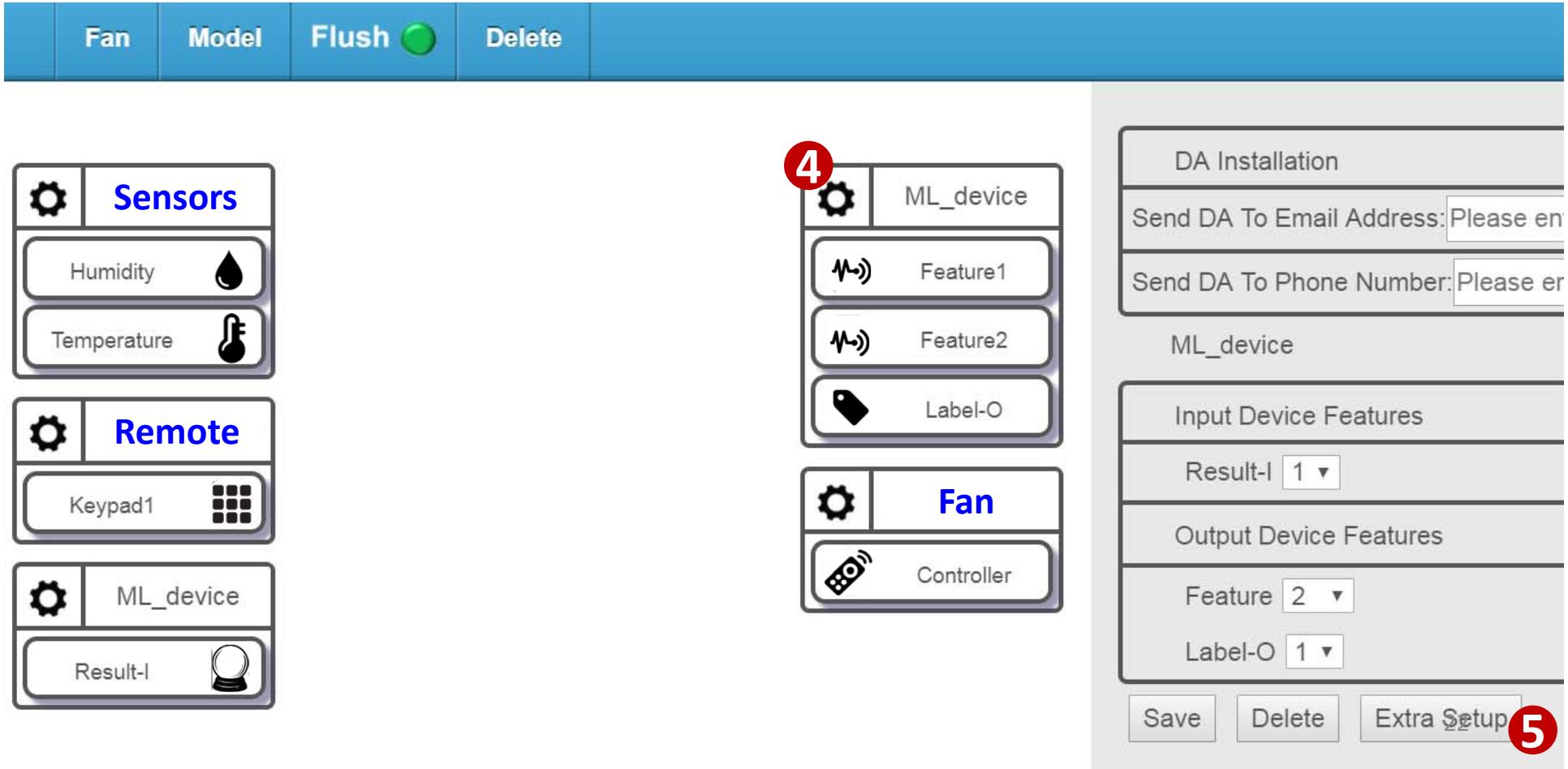


# Add a Machine Learning Device

4. Click the sign “gear” of the ML_device

# Add a Machine Learning Device

4. Click the sign “gear” of the ML_device
5. Click the “Extra Setup” button, a window pops up for detailed configuration



Device Name : DecisionTree

Feature extraction : Stages 2

Stage 0 2

Stage 1 2

| | 1 | 2 | |
|---|---|---|---|
| Standardize | ✓ | | ✓ 1 |
| Standardize | | ✓ | ✓ 2 |

Stage 2 1

| | 1 | 2 | | |
|---|---|---|---|---|
| Sparse coding | ✓ | ✓ | ✓ | ✓ 1 2 |

select all | select none | reverse select

Algorithm : Classification

- ☐ SVM
- ☐ kNN
- ☑ Decision Trees show/hide setting

Decision Trees

max_depth : 6

☐ user define show/hide setting

Validation : k-fold cross validation k : 10

Ensemble : Decision Trees

Training data

Simulation OFF | Import | Export

DA Installation

end DA To Email Address: Please enter your email add send

end DA To Phone Number: Please enter your phone nu send

ML_device

Input Device Features

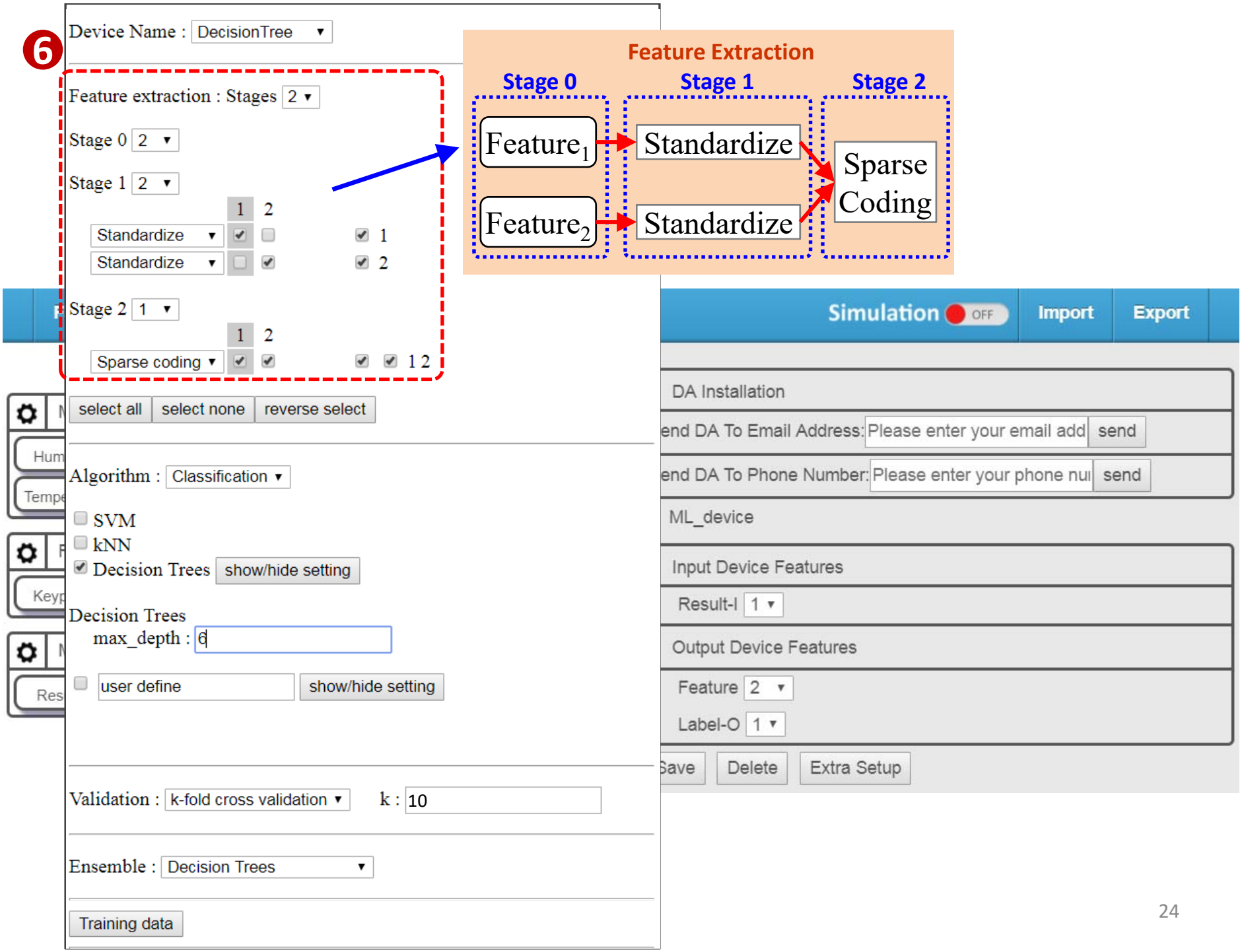
Result-I 1

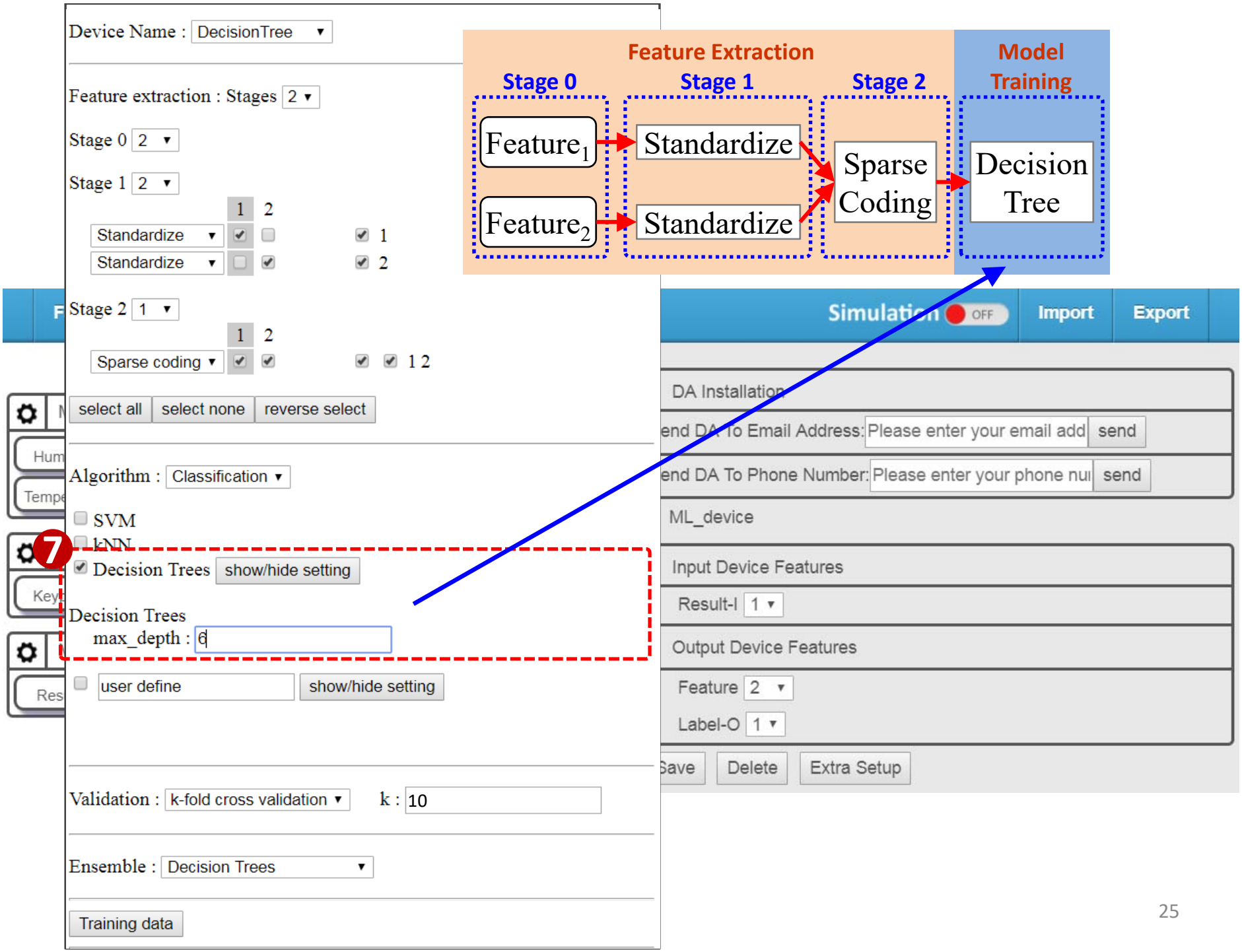
Output Device Features

Feature 2

Label-O 1

Save | Delete | Extra Setup


6
Device Name : DecisionTree
Feature extraction : Stages 2
Stage 0 2
Stage 1 2
1 2
Standardize
Standardize
1
2
Stage 2 1
1 2
Sparse coding
1 2
select all
select none
reverse select
Algorithm : Classification
SVM
kNN
Decision Trees
show/hide setting
Decision Trees
max_depth : 6
user define
show/hide setting
Validation : k-fold cross validation
k : 10
Ensemble : Decision Trees
Training data
Feature Extraction
Stage 0
Stage 1
Stage 2
Feature1
Feature2
Standardize
Standardize
Sparse Coding
Simulation
OFF
Import
Export
DA Installation
end DA To Email Address:
Please enter your email add
send
end DA To Phone Number:
Please enter your phone nu
send
ML_device
Input Device Features
Result-I 1
Output Device Features
Feature 2
Label-O 1
Save
Delete
Extra Setup


Device Name : DecisionTree
Feature extraction : Stages 2
Stage 0 2
Stage 1 2
1 2
Standardize
Standardize
1
2
Stage 2 1
1 2
Sparse coding
1 2
select all
select none
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Algorithm : Classification
SVM
kNN
7
Decision Trees
show/hide setting
Decision Trees
max_depth : 6
user define
show/hide setting
Validation : k-fold cross validation
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Ensemble : Decision Trees
Training data
Feature Extraction
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Stage 0
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Stage 2
Feature1
Feature2
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Standardize
Sparse Coding
Decision Tree
Simulation
OFF
Import
Export
DA Installation
end DA To Email Address:
Please enter your email add
send
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ML_device
Input Device Features
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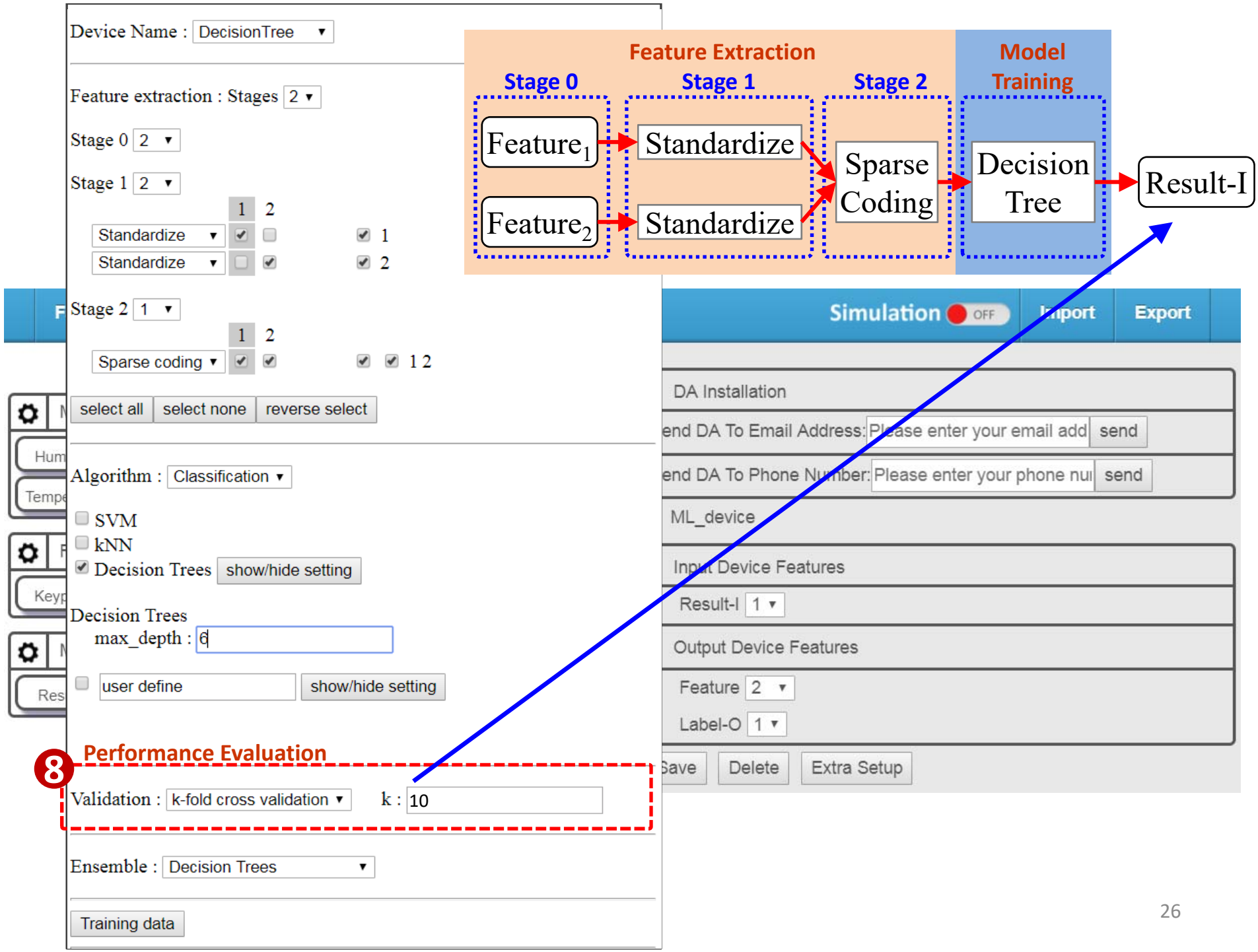
Extra Setup


Device Name : DecisionTree
Feature extraction : Stages 2
Stage 0 2
Stage 1 2
Standardize
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Sparse coding
select all
select none
reverse select
Algorithm : Classification
SVM
kNN
Decision Trees
show/hide setting
Decision Trees
max_depth : 6
user define
show/hide setting
8
Performance Evaluation
Validation : k-fold cross validation
k : 10
Ensemble : Decision Trees
Training data
Feature Extraction
Model Training
Stage 0
Stage 1
Stage 2
Feature1
Feature2
Standardize
Standardize
Sparse Coding
Decision Tree
Result-I
Simulation
OFF
Import
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DA Installation
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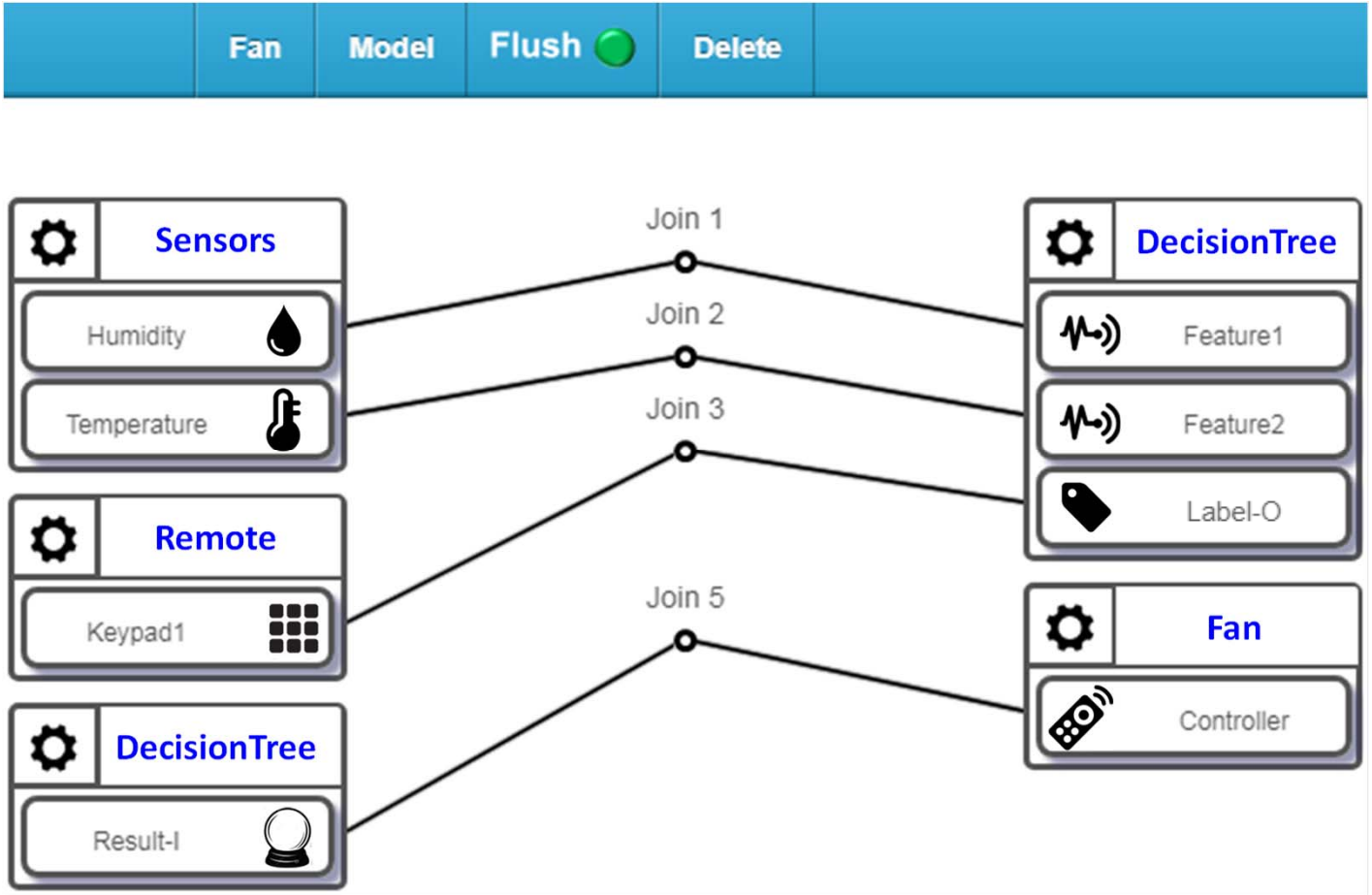
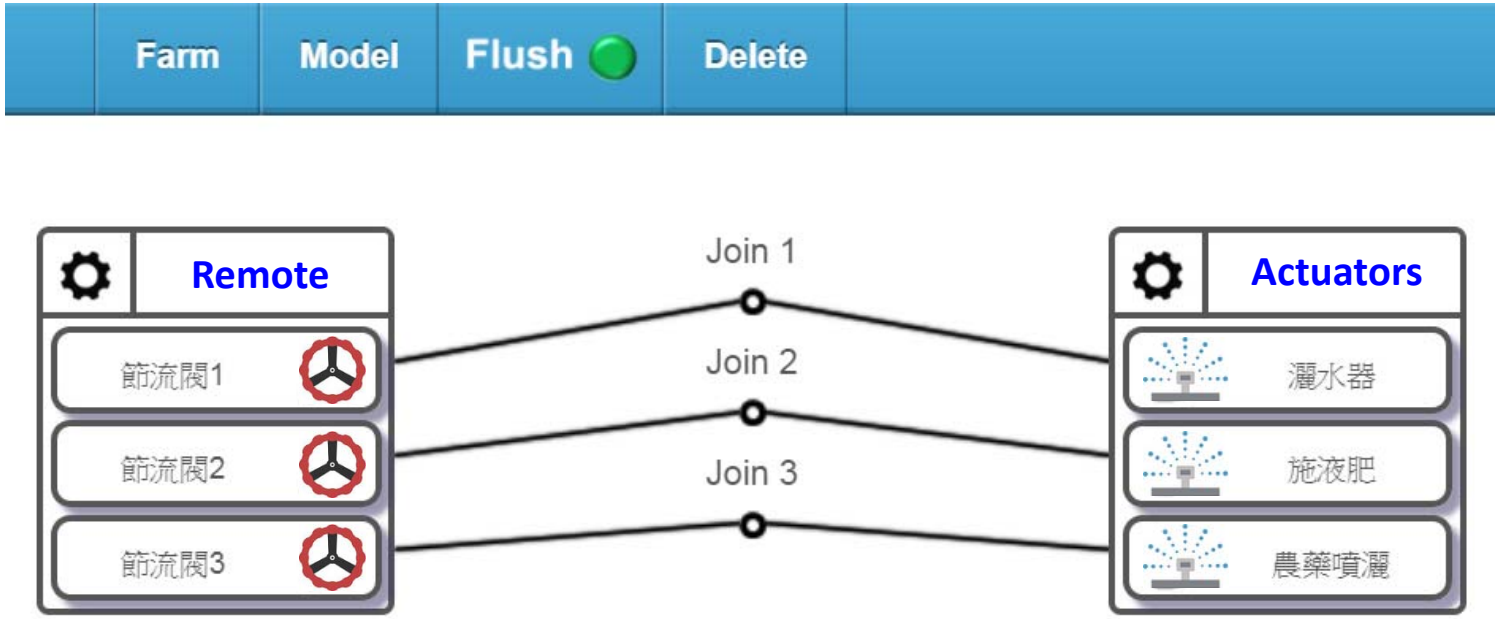
send DA To Phone Number:
Please enter your phone nu
send
ML_device
Input Device Features
Result-I 1
Output Device Features
Feature 2
Label-O 1
Save
Delete
Extra Setup

# AI Smart Fan

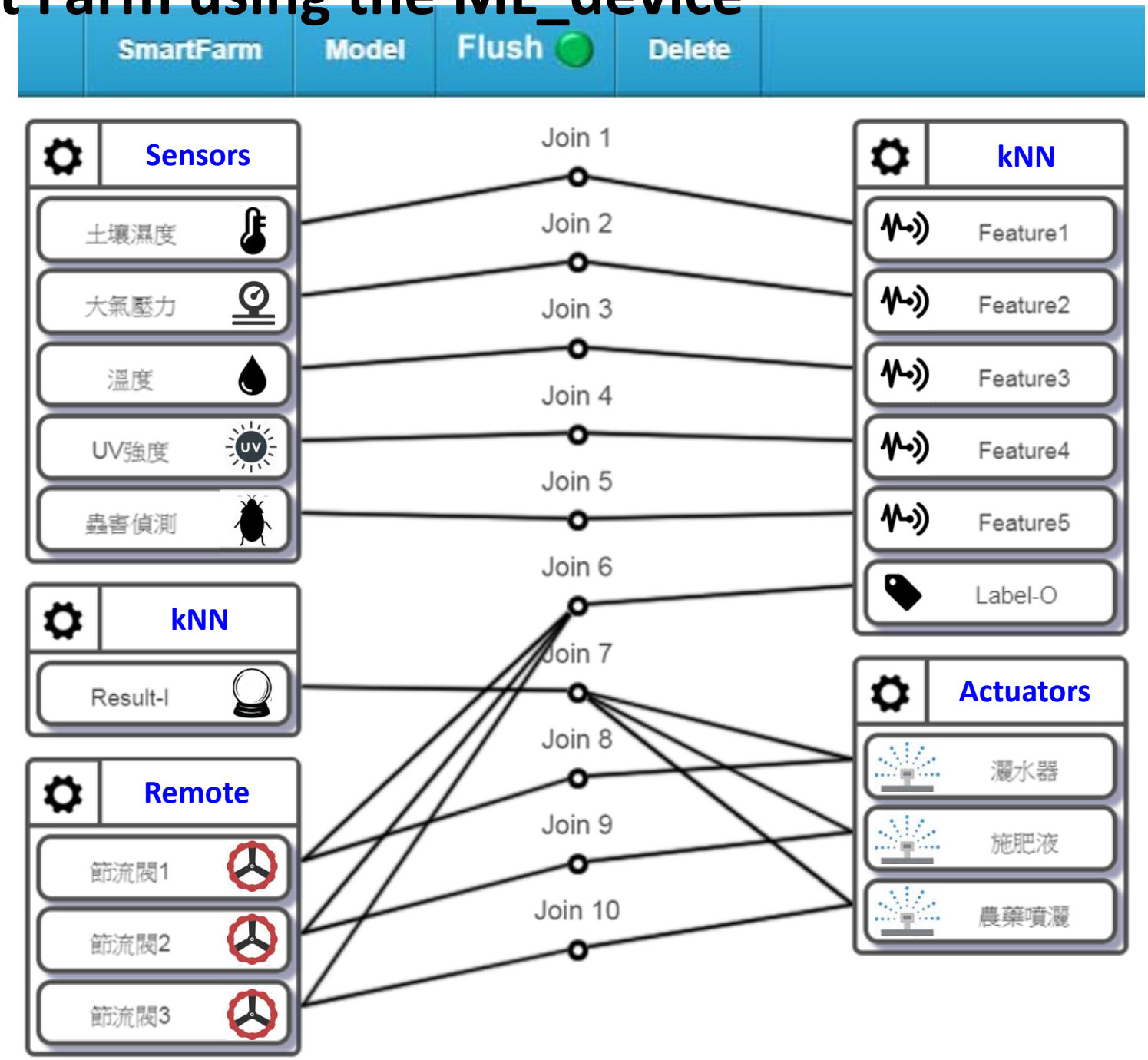
- Create links between Sensor, Decision, and Fan.
- The ML_device predicts results based on user's behaviors after finishing model training



# Farm Management using IoTtalk



# Smart Farm using the ML_device

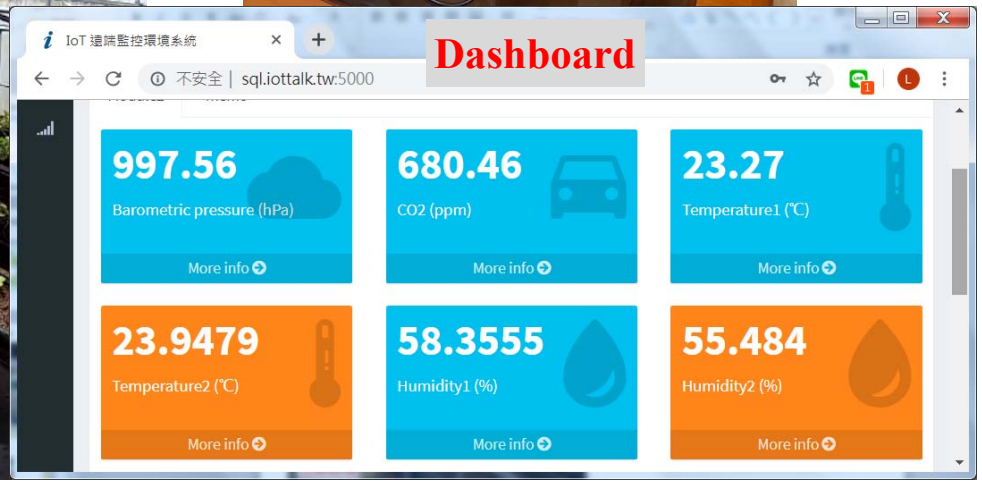


# Smart Farm


1.0X
Baoshan Farm


Quanta
SensorBox


按下 Esc 即可結束全螢幕模式
Wufeng Farm


IoT 遠端監控環境系統
不安全 | sql.iottalk.tw:5000
Dashboard
997.56
Barometric pressure (hPa)
More info
680.46
CO2 (ppm)
More info
23.27
Temperature1 (℃)
More info
23.9479
Temperature2 (℃)
More info
58.3555
Humidity1 (%)
More info
55.484
Humidity2 (%)
More info

# Disease Predation in Agriculture

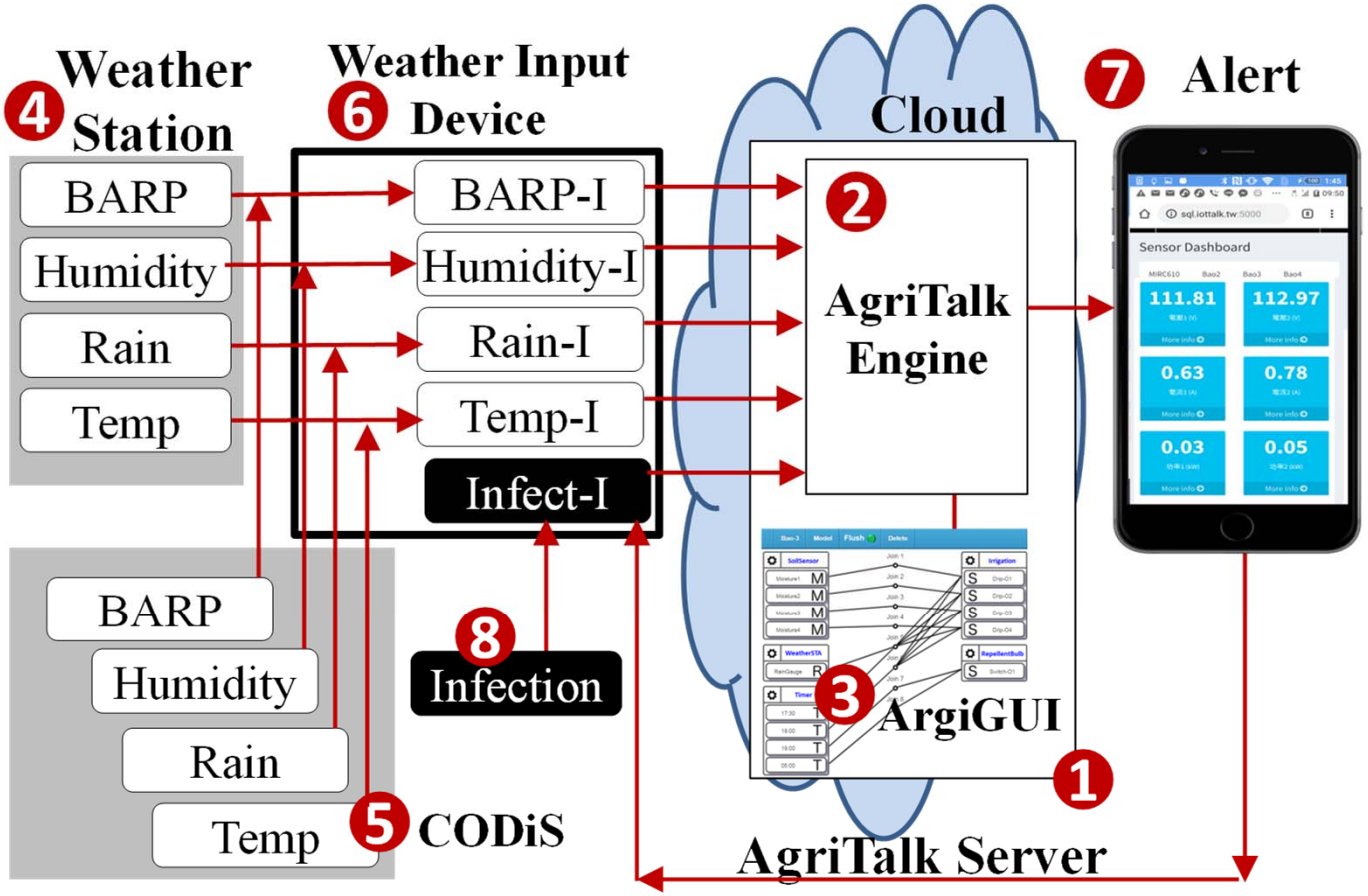
- Rice Blast



# Rice Blast Detection

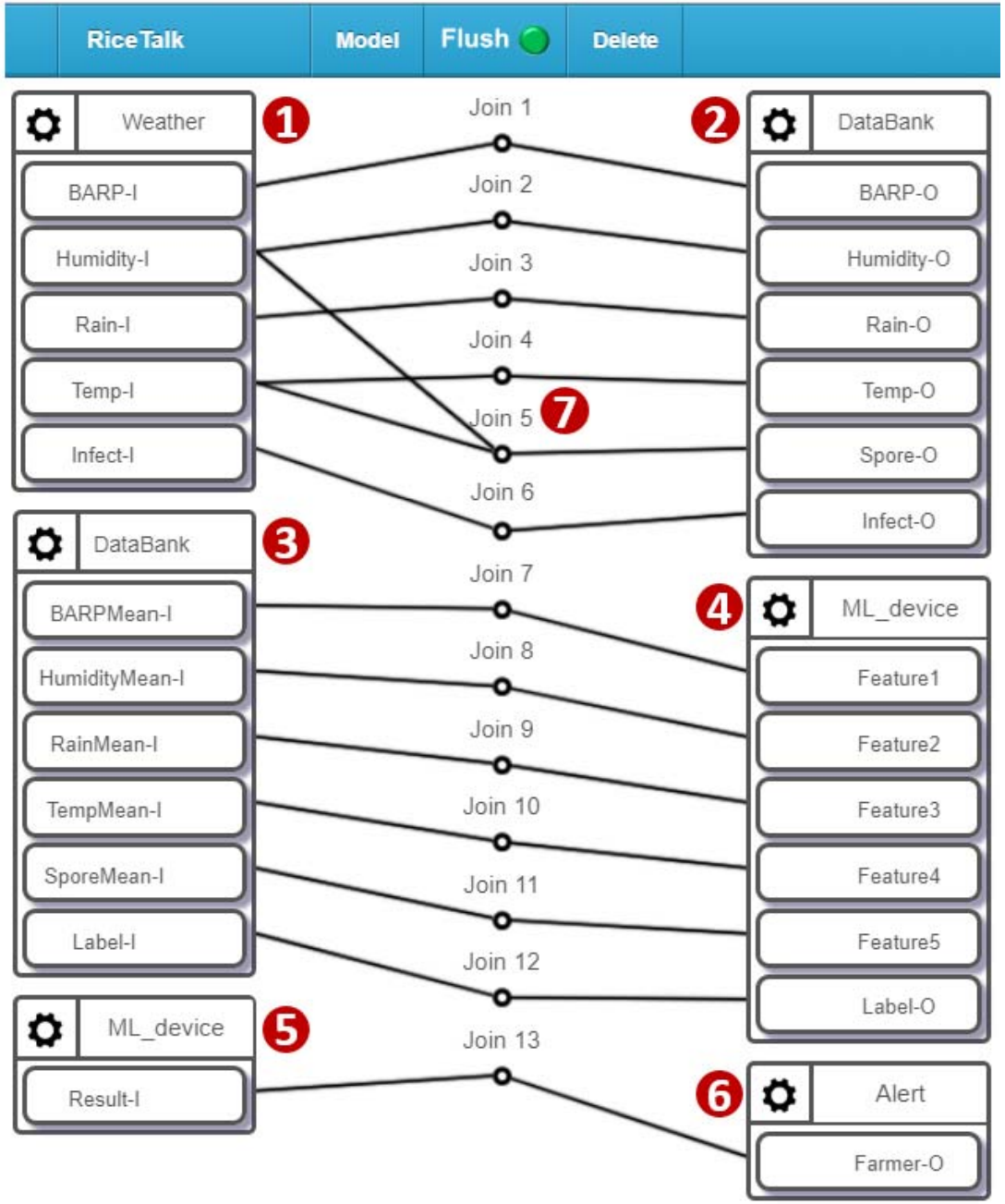
- The weather historical data come from CODiS
- The corresponding labels come from the Bureau of Animal and Plant Health Inspection and Quarantine

# RiceTalk: Non-Image Rice Blast Detection

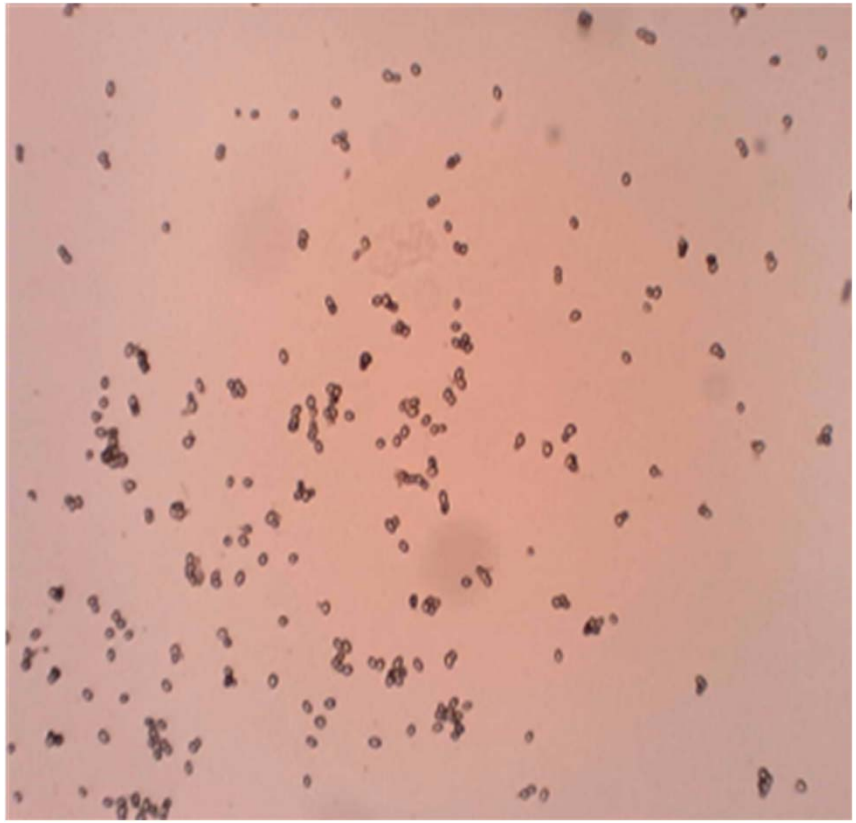


# Rice Blast Detection

- Time series data
  - DataBank slices data
  - Observation period
- TensorFlow
  - CNN
- Positive prediction : 89.4%



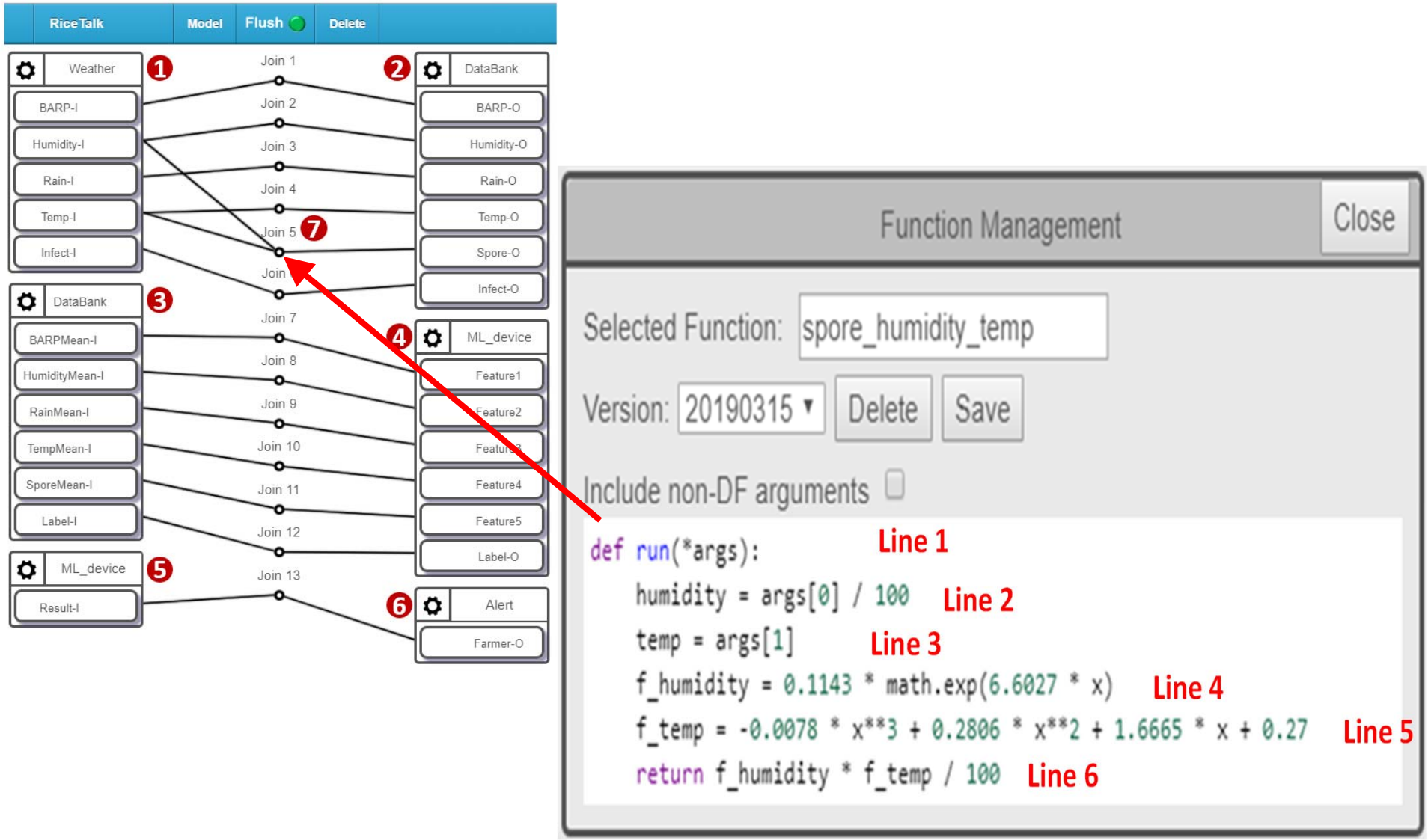
# Spore Germination Prediction



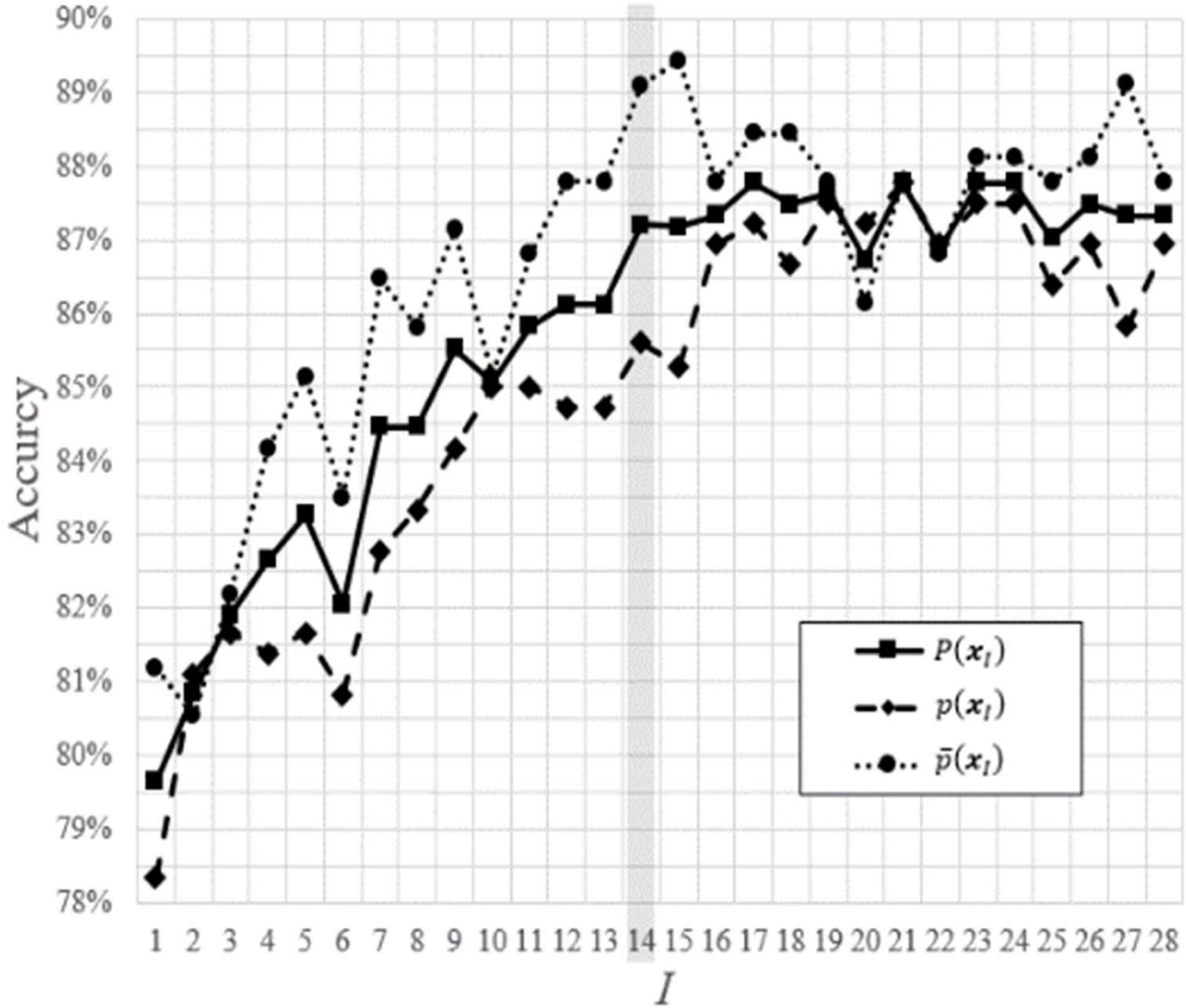
**No Spore Germination**

**Spore Germination**

# Spore Germination Prediction

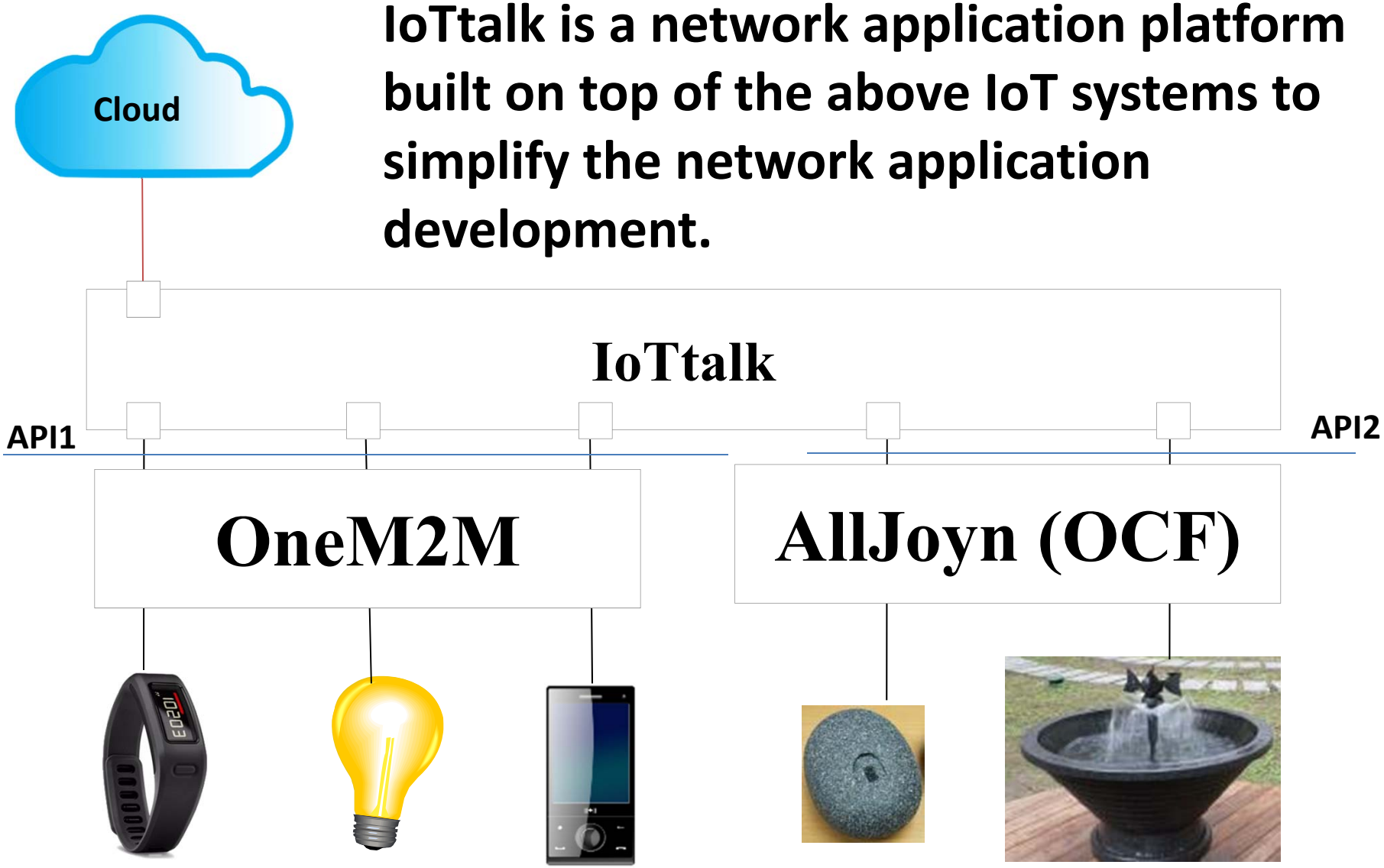


# Observation Period



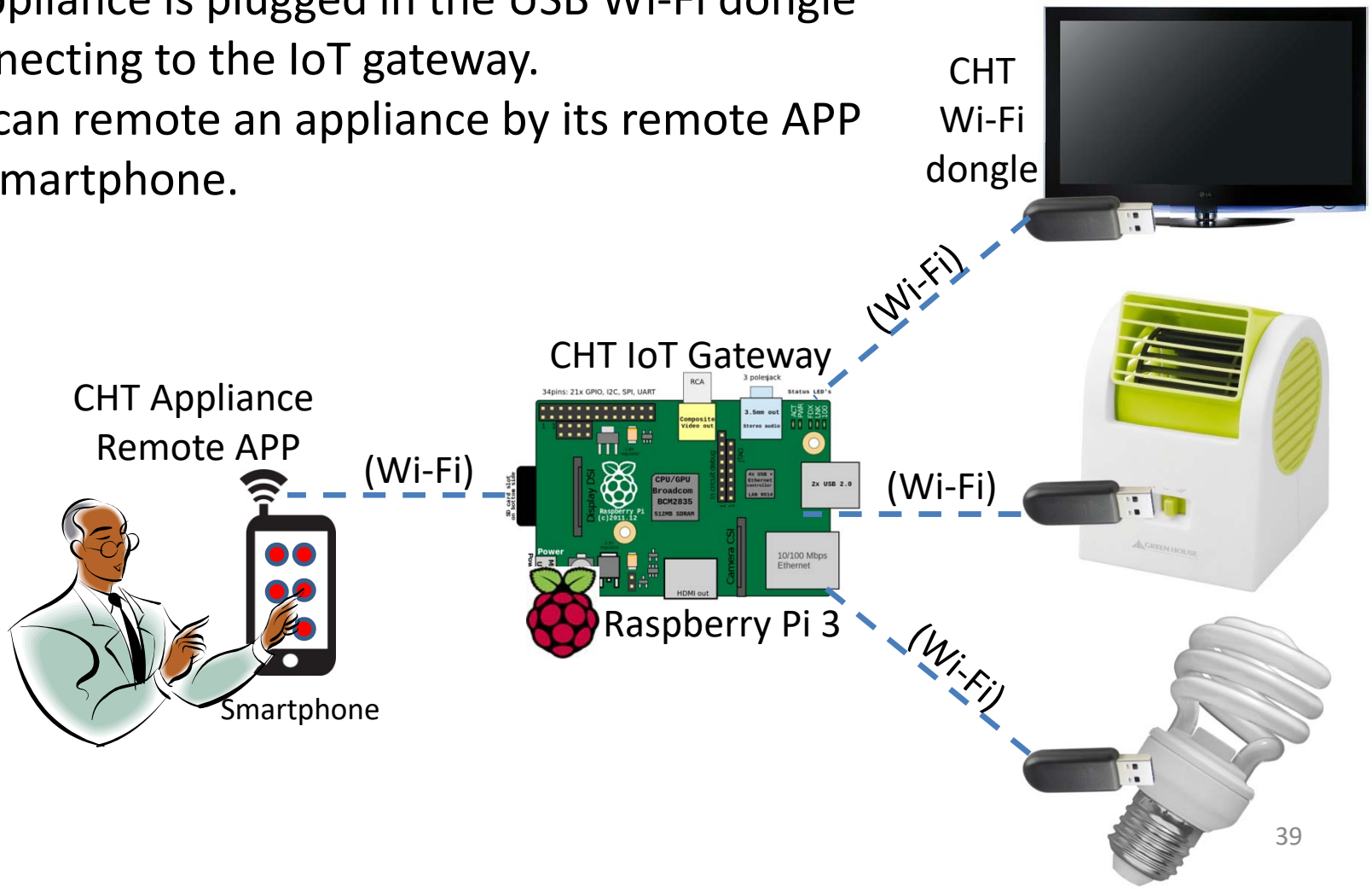
# Inter-Platform Communication

**IoTtalk is a network application platform built on top of the above IoT systems to simplify the network application development.**

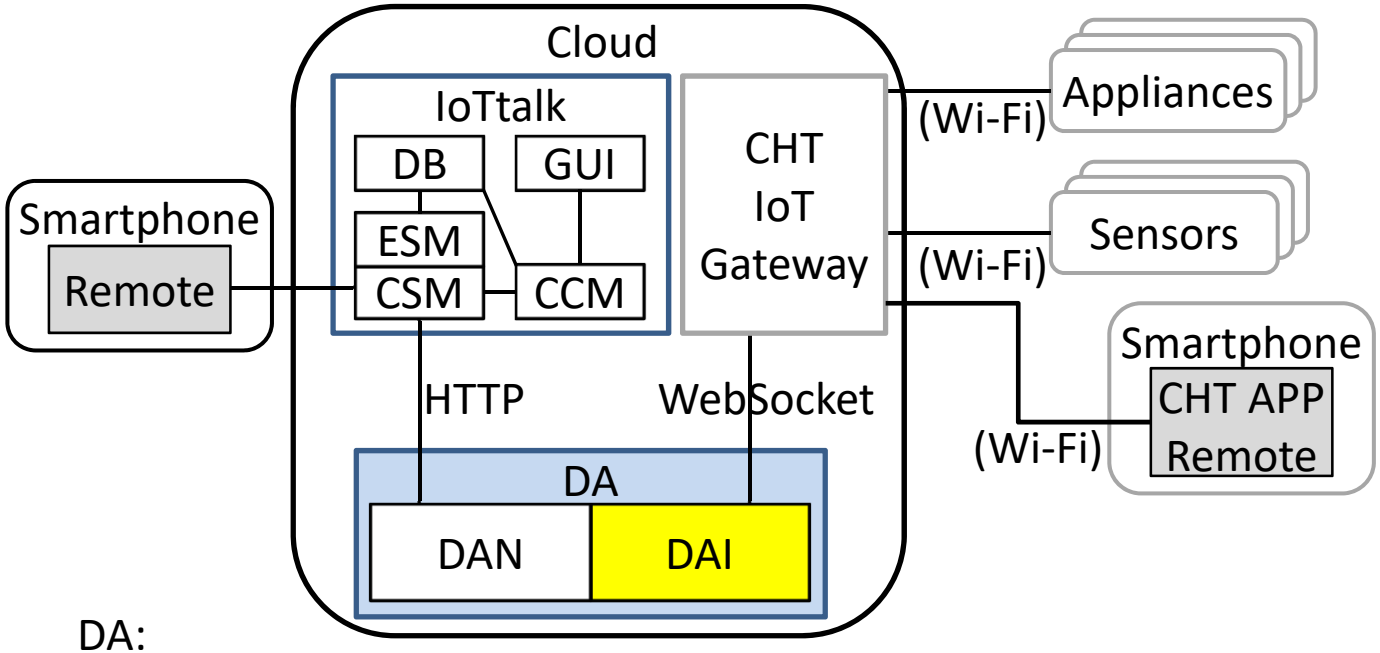


# Example: The Smart Home Solution by CHT

- Chunghwa Telecom (CHT) provides a smart home solution through a USB dongle and an IoT gateway.
- Each appliance is plugged in the USB Wi-Fi dongle for connecting to the IoT gateway.
- A user can remote an appliance by its remote APP in the smartphone.



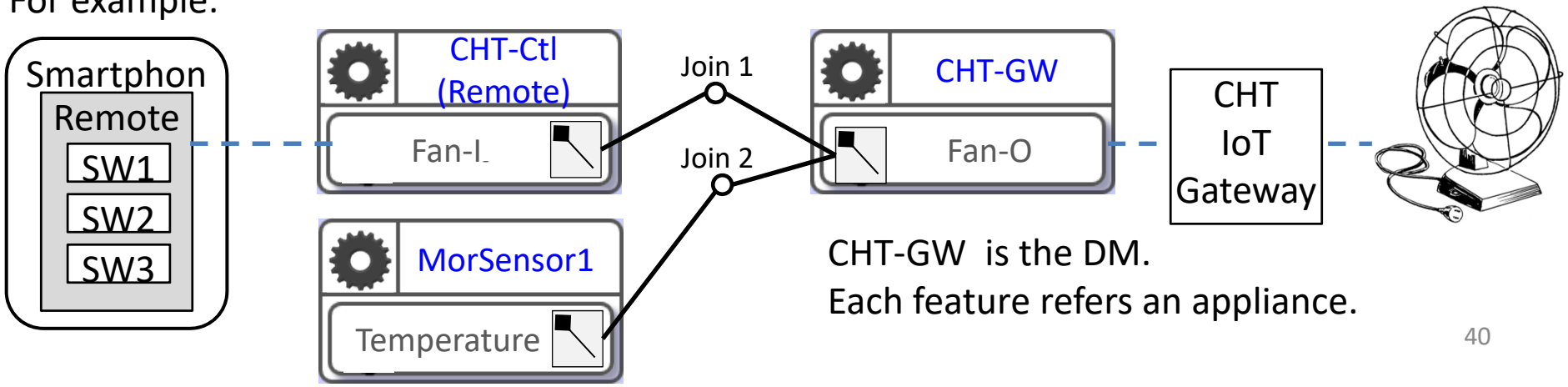
# CHT Smart Home with IoTtalk




DA:

1. *Register*/*Deregister* for appliances/sensors according to notifications
2. *Pull* **commands** from the IoTtalk server to CHT home server
3. Receive **sensor data** then *Push* them to the IoTtalk server

For example:




CHT-GW is the DM.
Each feature refers an appliance.

You can try IoTtalk at:

**https://test.iottalk.tw**

Any question?