Case Study 1: “Paddy Watch”

- Monitoring of rice fields
- Works without a power supply (battery)
- docomo × Vegetalia × Akita Prefecture × Kubota

<Meeting with the representatives from nine regions throughout Japan>
System for rice-paddy water management

Remote monitoring via sensors
Sensors in paddies collect data on water level, water temperature, etc. to enable anytime, anywhere monitoring.

- Water level
- Water temp.
- Air temp.
- Humidity
### Expected benefits of Paddy Watch

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>About 35% reduction of labor for inspecting paddy</td>
<td>Improved rice quality &amp; taste through analysis of sensor-collected data</td>
</tr>
</tbody>
</table>

#### Water level management

- **Rice planting**
- **Developing period**
- **Flower formation period**
- **Ripening period**
- **Ripe**
Collaboration with Niigata city

Paddy Watch trialed in Niigata area
— One of Japan’s major rice-producing regions —

Niigata is designated as a strategic district for developing more competitive agro-business to help stimulate rural Japan.

460 hectares of rice paddies and 300 sensors installed in paddies.
Measurement Accuracy

Technology dissemination organizations in 36 prefectures nationwide

High accuracy 18%
Capable for practical use 37%

High accuracy 27%
Capable for practical use 60%

22 Agriculture corporations and private farmers in Niigata City

Evaluation of technical experts is a little harsh
Satisfaction of producers is high
Case Study 2: “Drones”

- Discovers and locates pine weevils*
- Measures material volume
- docomo × Nigata-city × Aerosense

*Destructive pest insects which attack and destroy pine trees

(System image)

Expected benefits:

- Locate infected trees ⇒ Quick, precise removal
- Calculate height of infected trees ⇒ Less costly logging
- More efficient countermeasures for pine wilt disease
Sensor data + drone - captured images

- Drone
- Images
- Application server
- Cloud
- Database server
- Big data analysis
- Input from botanists
- Sensor-collected data
- Determine risks of insects & weeds
- Forecast best timing for fertilization & harvesting

- Rice
- Paddy Watch
- Mobile Communications
- Internet
More economical rice farming

Determine risks of insects & weeds
Forecast best timing for fertilization & harvesting

Higher quality, bigger yields and lower costs
Remote sensing with drones

Smart drones that could learn to locate & measure diseased trees

- Locate infected trees
- Measure heights of infected trees using stereopsis

Image analysis (Stereopsis)
Input from botanists

Camera
Drone

Pine
Pine wilt nematode
Longhorn beetle

Stereopsis image
Expected benefits

- Locate infected trees ⇒ Quick, precise removal
- Calculate height of infected trees ⇒ Less costly logging

More efficient countermeasures for pine wilt disease
Case Study 3: “Mobile Gyu-On-kei*”

*Calving Monitor

- Monitoring of **the delivery timing** of the mother cow
- Tied up with Japan Agricultural Cooperatives (JA)
- docomo × JA × Remote, Inc.

**System image**

**Temperature change graph**

- Upper temperature 40.5 °C
  - Preparation alert 9/2 • 14:30
- Bottom temperature 37.0 °C
  - Call to action 9/3 • 13:05

**Preparation alert**

**Call to action**

Farm ID: 1234
Name: Gyu-taro
Temp.: 38.4 °C
Preparation alert
http://gs00.remote.co.jp?no=220000004329
2018-07-06 16:55
Mobile Gyu-On-Kei
(Cow Temperature Measurement with Benefit)

To measure the deep part reaction in every 5 seconds.

To detect the 24 hours before delivery from a slight change in the body temperature.

Notice by mail

A typical sample of a mail

Farm
ID: 1234
Name: Gyu-taro
Temp.: 38.4 °C
Preparation alert
http://gs00.remote.co.jp/no=2200000004329
2018-07-06-16:55
It is a simple sensor but various knowledge from the field is condensed into it

<table>
<thead>
<tr>
<th>Component</th>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stopper</td>
<td>• Preventing probable dropping at the first water breaking</td>
</tr>
<tr>
<td>Battery</td>
<td>• A battery for 5 years (no need to change)</td>
</tr>
<tr>
<td>Antenna</td>
<td>• Winding the antenna to the tail</td>
</tr>
</tbody>
</table>

![Diagram of sensor components](image)

- Stopper
- Battery
- Antenna
- Sensor
- Radio signal processing unit
To support the wagyu production nationwide

Demonstration test for evaluating the performance
(by National Agriculture and Food Research Organization)

<table>
<thead>
<tr>
<th>Number of delivery:</th>
<th>Notice on 24 hours before: 142 (Notice in the night: 99)</th>
</tr>
</thead>
<tbody>
<tr>
<td>167</td>
<td>Notice at the time of water breaking: 25</td>
</tr>
</tbody>
</table>

Sales Figure

About **900 sets**

About **JPY 400,000,000**
(From June 2014 to MARCH 2017)
Case Study 4: “Farm note Color”

- Monitors **the sexual excitement** of female cows
- Commercially distributed by the JA group
- docomo × JA group × Farmnote

Using a motion sensor

Estrus Level, Activity Level
Case Study 4': “Farm note ecosystem”

- Upload to Cloud Server
- Ecosystem for cow form
- Abnormality detection
- Monitoring activity level
- Searching individual identification
- Estimating condition of cow using AI
- Searching individual identification using smart device
- Smart device
Case Study 5: “ICT Buoys & Drones”

- Understands the environment for seaweed and oyster farming
- Measures **sea water temperature** and **salinity**
- docomo × Saga-Prefecture × Optim × fishermen's association

<!-- System image -->

<!-- Application image -->
Case Study 6: “Hog Raising（Trial）”

- Measures the weight of a pig by using image recognition
- Reduction of production control cost
- docomo×Data-Horizon×Canon×Hirata ranch

Ecosystem for pig farming

- Pigsty
- Camera
- Temperature, humidity etc.
- Detecting remaining amount of feed
- LPWA
- Image identification system / head count and weight engine
- Feed balance
- Estimate of Head count / weight
- Temperature, humidity etc.

Pig farmer

Management system for pig farming