Introduce of IoT solutions and related promotion for agriculture

Driving growth of the Japanese industry through mobile solutions

Hideyuki Iwata
NTT
Rice Growing ICT
Two large-scale demonstration projects
Expected benefits of Paddy Watch

About 35% reduction of labor for inspecting paddy

Improved rice quality & taste through analysis of sensor-collected data

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.
Initiative #1: “PaddyWatch”

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

<System image>

<Meeting with the representatives from nine regions throughout Japan>
Remote monitoring via sensors
Sensors in paddies collect data on water level, air temperature, etc.
to enable anytime, anywhere monitoring
Measurement Accuracy

Technology dissemination organizations in 36 prefectures nationwide

- High accuracy: 18%
- Capable for practical use: 37%
- 24%
- 16%

22 Agriculture corporations and private farmers in Niigata City

- High accuracy: 27%
- Capable for practical use: 60%
- 9%
- 4%

Evaluation of technical experts is a little harsh

Satisfaction of producers is high
Initiative #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

- **Rice**
  - Drone
  - Cloud
    - Application server
    - Database server
  - Mobile Communications
  - Internet
  - Paddy Watch
  - Images
  - Big data analysis
  - Input from botanists
  - Sensor-collected data

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

Images

Drone
Camera
Pine
Longhorn beetle
Pine wilt nematode

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
Activities in the field of cattle raising:
Detection of childbirth sign of the cow
The calf price is soaring

Wagyu, the Japanese cattle, is very vulnerable

- Many delivery accidents (Accident rate: 5%)
- Often the actual delivery date shifts one week from the expected date

The number of those who abandon the agriculture is increasing
Initiative #3: “Mobile Gyu-On-kei* 

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

Using a temperature sensor

*Calving Monitor
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

●●牧場様
ID: 1234
名称：牛太郎
温度：38.4℃
段取り通報です。（2-2）
(Preparation alert)
http://gs00.remote.co.jp
?no=220000000004329
2014-08-14 20:35
It is a simple censor 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>

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![Diagram of censor components](image)
Initiative #4: “Farmnote 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
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</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Notice in the night: 99)</td>
</tr>
<tr>
<td></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)
Initiative #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**
Initiative #6: Hog Raising (Test)

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

<System image>
## DOCOMO’S Role

<p>| | |</p>
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Nationwide expansion</strong></td>
<td>A national branch / sales network</td>
</tr>
<tr>
<td><strong>Collaboration support</strong></td>
<td>Connects startups to large companies and local governments</td>
</tr>
<tr>
<td><strong>Operative system</strong></td>
<td>Instruction manuals/tutorial videos for users</td>
</tr>
<tr>
<td><strong>Technological assistance</strong></td>
<td>Wireless communication technology/ systems construction support from Docomo R&amp;D</td>
</tr>
</tbody>
</table>
The "Agriculture ICT Project"

“Driving the growth of Japanese agriculture through mobile solutions”

Started with two women

Two women in one organization

Staff from across the nation joined the project
Philosophy

- Share solutions for social problems
- Become open minded
- Win-Win ecosystem
- Listen and adopt opinions from women farmers
- Build local communities
- Design IoT
Expanding to other social areas

Agriculture

Education

Tourism

Healthcare
Evolution to the "IoT Design Project"

The IoT design project

"IoT design by women"

IoT contributes to better productivity increased value

The agriculture ICT project

“Women in agriculture"
Start projects in various industries with MIC*

"IoT Design Projects by Women"

Companies

Local governments

*MIC: Ministry of Internal Affairs and Communications