“Approach to smart agriculture utilizing drones, sensors and AI”

Kazuhito Hayami
OPTiM Corporation
Industry Department, Marketing Manager
(In charge of our Smart Agriculture solutions)
### Company Outline

<table>
<thead>
<tr>
<th>Corporation</th>
<th>OPTiM Corporation (Tokyo Stock Exchange, First Division: 3694)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locations</td>
<td>Saga Office: OPTiM Headquarters Building, 1 Honjo-machi, Saga</td>
</tr>
<tr>
<td></td>
<td>Tokyo Head Office: Shiodome Building 21F, 1-2-20 Kaigan, Minato-ku, Tokyo</td>
</tr>
<tr>
<td></td>
<td>Kyukodai-mae Office: 680-41 Center of Iizuka Research &amp; Development 103, Kawazu, Iizuka-shi, Fukuoka</td>
</tr>
<tr>
<td>President</td>
<td>Shunji Sugaya</td>
</tr>
<tr>
<td>Date of Establishment</td>
<td>June 8th, 2000</td>
</tr>
<tr>
<td>Capital stock</td>
<td>411,356,000 Yen</td>
</tr>
<tr>
<td>Fiscal year-end</td>
<td>March</td>
</tr>
<tr>
<td>Employees</td>
<td>450 (including contract and part-time staff)</td>
</tr>
<tr>
<td></td>
<td>80 percent of OPTiM staffs are system engineers</td>
</tr>
<tr>
<td></td>
<td>Average staff age: 33.3</td>
</tr>
<tr>
<td>Major stockholders</td>
<td>Shunji Sugaya, NIPPON TELEGRAPH AND TELEPHONE EAST CORPORATION, Fuji Xerox Co., Ltd.</td>
</tr>
<tr>
<td>Main business</td>
<td>License sales and maintenance support services -- i.e. Optimal business solutions (IoT Platform Services/Remote Management services/Support services, etc.)</td>
</tr>
</tbody>
</table>
Accelerating collaborative research with Saga University to develop next-generation technology
OPTiM’s Values

To OPTiM, “Intellectual property is the fruit of innovation”

Our founder/CEO recognized as the #1 individual in the ranking of “Patent Asset Scale among Japanese in the Information Communication Industry between 1993 and 2015”

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**Table: Comprehensive Patent Rankings for Electronic Device Management** (2014)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Company</th>
<th>Comprehensive Power (top 10 list)</th>
<th>Valid Patents</th>
<th>Individual Power (top 10 list)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Panasonic</td>
<td>612.0</td>
<td>86</td>
<td>78.8</td>
</tr>
<tr>
<td>2</td>
<td>Sharp</td>
<td>275.2</td>
<td>120</td>
<td>73.7</td>
</tr>
<tr>
<td>3</td>
<td>OPTiM</td>
<td>271.1</td>
<td>30</td>
<td>72.9</td>
</tr>
<tr>
<td>4</td>
<td>Mitsubishi Electric</td>
<td>186.4</td>
<td>26</td>
<td>72.5</td>
</tr>
<tr>
<td>5</td>
<td>Toshiba</td>
<td>166.2</td>
<td>32</td>
<td>79.3</td>
</tr>
</tbody>
</table>
Corporate Mission Statement

OPTiM’s Strategy 「○○×IT」

We strive to approach to the 4th Industrial Revolution era with 「○○×IT」 projects, combining our AI, IoT and robotics with every industry.
Medical × IT
(Supporting fundus examination and eye image analysis)

Saga University and OPTiM are working for early detection and treatment of glaucoma, diabetic retinopathy, and age-related macular degeneration by analyzing clinical ocular image data by AI using deep learning to improve diagnosis accuracy and speed.
New IoT platform 「LANDLOG」 connecting all construction processes.

Joint Venture with Komatsu

Analysis and visualization of construction machinery, track and workers by Deep learning (Object detection, Domain extraction etc.)
AI Application in Railway

Railway × IT
(Security for unstaffed station)

AI image analysis of live camera feed. When danger is detected, an alert is sent to security staff.

Trial experiment with of AI monitoring at JR train platform.
Aquaculture × IT
(Improving yield and quality nori seaweed in Ariake Sea)

Integrate images from drones with sensor data from ICT buoys (water temperature, salinity concentration, etc.) on Cloud IoT OS. Perform image analysis and predict disease breakouts.
To make the agriculture more enjoyable, appealing and profitable by utilizing AI, IoT and Robotics.
Smart Agriculture Project in Japan

We have been applying our smart agriculture solutions on 18 crops in 18 prefectures in Japan.

- Ishikawa: Spot spraying (rice)
- Shiga: Remote support (Kaki)
- Hyogo: Spot spraying (soybean), Remote support (onion)
- Hokkaido: Yield Prediction (Wheat)
- Aomori: Insect detection (rice), Gap support (Garlic)
- Fukushima: Growth monitoring (soybean)
- Ibaraki: Spot spraying (cabbage), Spot spraying (broccoli), Spot spraying (potato)
- Chiba: Spot spraying (rice)
- Yamanashi: Yield prediction (tomato)
- Shizuoka: Growth monitoring (olive)
- Saga: Spot spraying (rice & soy), Yield prediction (tomato), Remote support (cucumber), Remote support (orange)
- Nagasaki: Growth monitoring (asparagus)
- Fukuoka: Spot Spraying (rice)
- Kagoshima: Growth monitoring (tea)
- Miyazaki: Gap support
- Okinawa: Yield prediction (strawberry)
- Oita: Spot spraying (rice)
Yield Prediction System (Object Detection and Maturity Degree)

**OPTiM Crawler**

- **Multi Camera Capability**
- **High Level Camera Stabilization**
- **AI Edge Computing Module**
- **Auto Driving System**
- **4WS/4WD Driving**

- **Object**
- **Color**
- **Temperature**

OPTiM Crawler
Easy Remote Work Support on a Smart Glass
Remote support with wearable Smart Glass enables young farmers to work with veteran level skills. Know-how and techniques are precisely passed on to new generation.

- **Pain Points**
  - Long hour physical tasks are tough on elderly farmers
  - Conventional training style using direct lecture strains both elder farmer and successor
  - Training new farmers while actually working at the same time is inefficient
Glider drone 「OPTiM Hawk」

This design is best suited for long flights over large areas, such as fisheries or forests.

Features

- 30+ km range, 1+ hour flight time
- Lightweight and rigid design by experienced Japanese designer
- Build-in electric gimbal for stable imaging
- Supports various wide area communication device, including OPTiM’s 920Mhz telemetry system (contact OPTiM for details)
Orthophoto (Obihiro, Hokkaido, 580ha)
Orthophoto (Obihiro, Hokkaido, 580ha)
NDVI from multispectral cameras for yield prediction analysis
Realizing a supply chain that is open, efficient, and reliable with distributed database technology featuring block chain. This technology can save and manage all points in the history of the produce, such as cultivation, distribution, and more - providing total traceability.
Leverages food traceability and ensure high reliability with tamper-resistant Blockchain technology

Food Supply Chain (Farmer→Processor→Distributor→Restaurant)

Manage food distribution using QR code and mapping with transaction data
AI can detect the damage from pests and diseases via pictures taken by drone ➞ Our technology can prevent insect damage in the early stage.
Smart Agri Project - Smart Soybeans Cultivation -

### Drone Spot Spraying Technology

1. Capture field whole image with automated flight drone
2. Locate pest affected spot with AI image analysis
3. Pinpoint pesticide spray at the spot with automated flight drone

### Observed factors:
- Reduction of residual pesticide amount
- Pesticide cost
- Yield
- Quality
- Labor cost

Normal Cultivation (controlled field)

Spay fertilizers and pesticides to the whole soybean field

Normal Field

SmartAgri Field

Smart Agri Project - Smart Soybeans Cultivation -

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Capture field whole image (290 pictures) with automated flight drone
Locate 39 pest affected spots with AI image analysis
Aerial images
AI image analysis for pest affected spots
AI image analysis for pest affected spots
Reduced 90% pesticide use!
Yield and quality (crop shape etc.) are retained at the same level as controlled field.
### Result of residual pesticide test

<table>
<thead>
<tr>
<th>Name of crops</th>
<th>TYPE</th>
<th>etofenprox</th>
<th>chlorantraniliprole</th>
<th>tefubenzuron</th>
<th>dinotefuran</th>
<th>quizalofop ethyl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edama me</td>
<td>Reference value at simultaneous spraying</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Edama me</th>
<th>Results when using a pinpoint pesticide spraying</th>
<th>No detected (&lt;0.01)</th>
<th>No detected (&lt;0.01)</th>
<th>No detected (&lt;0.01)</th>
<th>No detected (&lt;0.01)</th>
<th>No detected (&lt;0.01)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edama me</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As of 19 OCT 2017

Unit: ppm
The secret of Smart Soybean deliciousness. It is because the combination of farmers hearts and the cutting-edge technology, Pesticide usage is reduced 90%, it is safe and secure soybean.

Safe, Secure and Tasty vegetables for you.
Test marketing at Department Store “Mitsukoshi Fukuoka”
### Smart Soybeans vs. Normal Soybeans

<table>
<thead>
<tr>
<th>Soy Bean price per 100 g</th>
<th>Smart Soybeans</th>
<th>Normal Soybeans</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>200 yen</td>
<td>67 yen</td>
</tr>
</tbody>
</table>

Data at Fukuoka Mitsukoshi

- **Sold at about 3 times price**

- The price is set based on famous brand price range such as Tanba’s Black Beans in Japan.
27th October 2017

Sold Beans at Department Store Mitsukoshi Fukuoka

SOLD OUT

Mitsukoshi Fukuoka
Sharing the updated OPTiM technologies including drone spot spraying with the future oriented farmers who are willing to apply the tech to their practices.
We are offering

Pin-point Pesticide Spraying Technology and Smart Agriculture Solution

to farmer across Japan

with free of charge !!
We will purchase a total amount of harvest produced with Pin-point Pesticide Spraying Technology and Smart Agriculture Solution
"Smart AgriFood Project" and Business model

1. Distribution of added revenue value

- Usual Produce
  - Processing, distribution, sales, expenses
  - Producer sales
- Smart AgriProduce
  - Processing, distribution, sales, etc, expenses
  - Producer sales

OptiM Revenue

Smart Agriculture solution expenses

Smart Agrifood Added value

2. Sale value increase

- Usual produce
  - Producer sales
- Smart Agrifood produce Sales
  - Additional producer sales revenue
  - Producer sales

Added Value benefits

Value

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“0” risk to utilize smart agriculture
(Reduction of labor for pesticide application, cost of pesticide, health risk by pesticides)

“0” risk to waste products by smart agriculture

“∞” potential to yield more profit
We succeeded in using Pin-point spray technology for pesticide application in black soybean field.

Reduced 99% pesticide use!
Saved 30% amount of effort!
Sold beans at Department Store Takashimaya Tokyo and vegetable stores
NEW release! "Smart Rise"

Up to Reduced 100% pesticide use!

"AI" and "drone" used.
"New cultivation method"

Application No. 6326009

Smart rice is the result of using AI and drones to implement a new cultivation method that challenges producers.
Smart-Agri Project
Plan for next step by crops and scale

<table>
<thead>
<tr>
<th>Year</th>
<th>Crop</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Start to conduct application in some areas and selling smart-agri products</td>
<td>Expanding application in all areas in Japan</td>
<td>Exporting to overseas</td>
</tr>
<tr>
<td>Rice</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soybean</td>
<td></td>
<td>Conducted testing Pinpoint spray technology in test fields</td>
<td>Expanding application in all areas in Japan</td>
<td>Exporting to overseas</td>
</tr>
<tr>
<td>Potato</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broccoli</td>
<td></td>
<td>Started to test selling agricultural products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cabbage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>And more</td>
<td></td>
<td></td>
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We are trying to make the best use of reducing the amount of pesticide.

In the future, **Pinpoint pesticide spray technology** will become a mainstream method of agriculture all over the world.
Our Pin-point spraying of pesticide application related technologies has acquisitioned the basic patent group in Japan and the US.

Patent number 6326009