

Launch of the World's First AI-Powered Buried Pipe Locating Software for Ground Penetrating Radar Systems

September 29, 2021

Osaka Gas Co., Ltd.

Osaka Gas Co., Ltd. (President: Masataka Fujiwara, Headquarters: Chuo-ku, Osaka), in collaboration with Nippon Signal Co., Ltd. (President: Hidehiko Tsukamoto, Headquarters: Chiyoda-ku, Tokyo) and HACARUS INC. (President: Kenshin Fujiwara, Headquarters: Nakagyo-ku, Kyoto), has developed the world's first "AI-powered automatic buried pipe locating software" that can identify the positions of underground pipes, such as gas pipes and water pipes, by using artificial intelligence (AI). Nippon Signal Co., Ltd. will start selling this software on October 1, 2021.

When excavating a road, it is necessary to identify the positions of buried pipes, such as gas pipes, water pipes, sewer pipes, and power/communication cables, in advance so as not to damage them. Osaka Gas uses ground penetrating radar systems to locate buried pipes. However, it is sometimes difficult to identify their exact positions due to the burial conditions, and therefore a certain amount of experience is required to identify the positions.

With the software developed this time, AI automatically analyses images scanned with a ground penetrating radar system and identifies the positions of buried pipes. High accuracy has been achieved by having AI learn the judgment skills of experienced workers. Therefore, this software enables even beginners to easily identify the positions of buried pipes.

In addition, by adopting "sparse modeling"*1 that can achieve high accuracy by learning only a small amount of data, Osaka Gas was able to reduce the time and cost of development. This software can be installed on existing ground penetrating radar systems.

The three companies will promote ground penetrating radar systems equipped with this software to gas, water, electricity and telecommunication utilities across Japan, so that they can conduct road excavation work in a safer and more secure manner, while continuing to work to improve the AI's judgment accuracy.

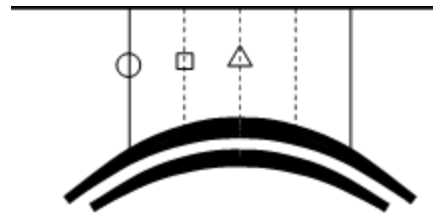
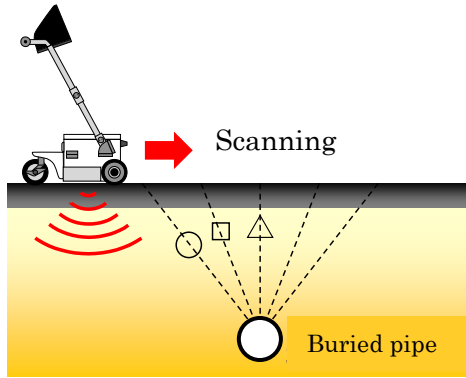
To create "future value" that contributes to solving social issues in cooperation with various stakeholders, the Daigas Group also works to promote DX, including the introduction of AI technology, to evolve into "an innovative energy and service company that continues to be the first choice of customers" and to contribute to realizing a sustainable society.

*1: An AI model developed by HACARUS INC. This technology enables AI to extract features from a smaller amount of data compared to "deep learning," which needs to learn a large amount of data, and perform learning and inference.

1. Search for buried pipes with a ground penetrating radar system

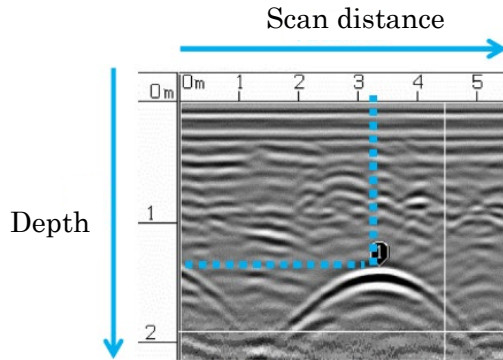
- The surface of the ground is scanned across buried pipes while emitting radio

- Schematic scan image
(Hyperbolic lines are indicated on a



- Actual scan image

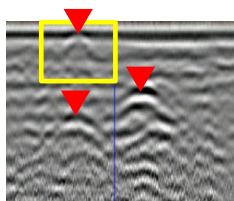
- Scanning work using a ground penetrating radar system



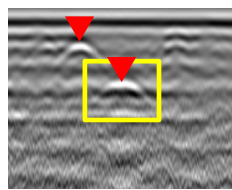
It is estimated that there is a buried pipe at a position of 3.2 m in the direction of travel and 1.4 m in depth.

Output screen

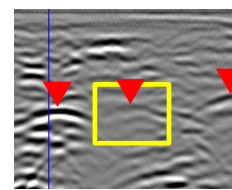
- Example images that are difficult to judge



Buried pipe near the pavement surface



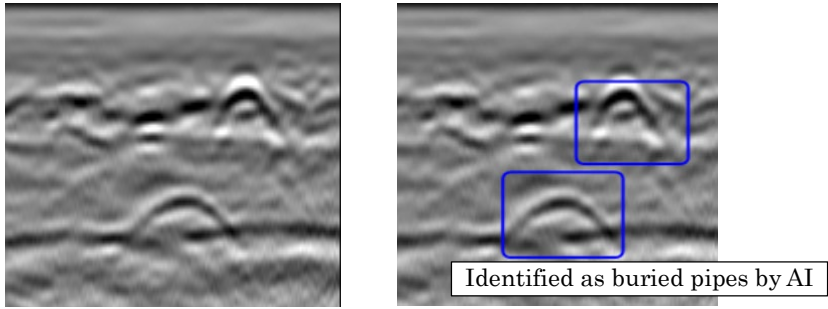
Soil with formations and groundwater



Soil in which radio waves attenuate significantly

▼ : Actual position of buried pipe

2. System overview

Product name	"AI-powered automatic buried pipe locating software" for ground penetrating radar systems														
Applicable systems and scheduled release time	GN-02 (Scan depth: Approx. 1.5 m): From October 2021 GN-04 (Scan depth: Approx. 0.6 m): Scheduled to be released in 2021														
Example of identification by AI	 <p style="text-align: center;">Scan data Example of judgment by AI</p>														
AI's judgment accuracy	<table border="1"> <thead> <tr> <th colspan="2">Evaluation item</th> <th>Average of site workers*</th> <th>AI</th> </tr> </thead> <tbody> <tr> <td>Successful detection rate</td> <td>Percentage of successful detection of pipes (larger values are better)</td> <td>76%</td> <td>89%</td> </tr> <tr> <td>False detection rate</td> <td>Percentage of detection of objects other than pipes (smaller values are better)</td> <td>36%</td> <td>8%</td> </tr> </tbody> </table> <p>* Sampling tests were conducted.</p>			Evaluation item		Average of site workers*	AI	Successful detection rate	Percentage of successful detection of pipes (larger values are better)	76%	89%	False detection rate	Percentage of detection of objects other than pipes (smaller values are better)	36%	8%
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