Highlights
Digital Solutions

SATLYS Toshiba Analytics AI Services Accelerating Business Transformation

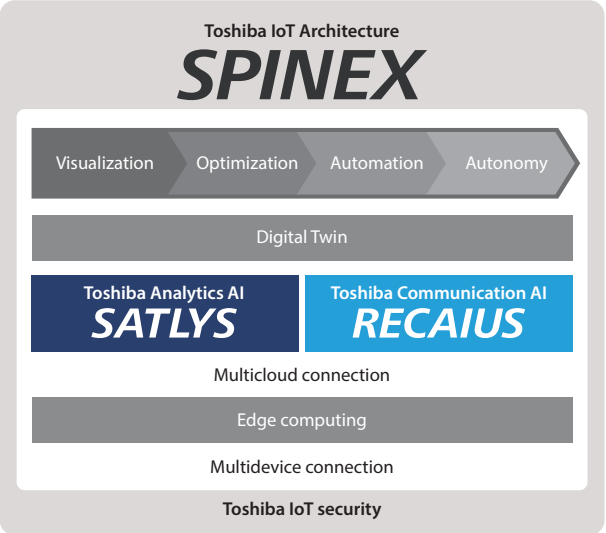
Industry is beginning to be affected by a number of social problems, including aging of the population, labor shortages, increasing energy demand, depletion of natural resources, and increasing physical distribution demand. In the manufacturing and maintenance fields, there are concerns over whether the dependence on experts' tacit knowledge and the increasing complexity of system operations might affect productivity and quality. The improvement of manufacturing and operating efficiency is therefore a pressing issue.

In response, Toshiba Digital Solutions Corporation released SATLYS, a suite of artificial intelligence (AI) analytics services, in October 2017 as a new addition to its SPINEX Internet-of-Things (IoT) architecture.

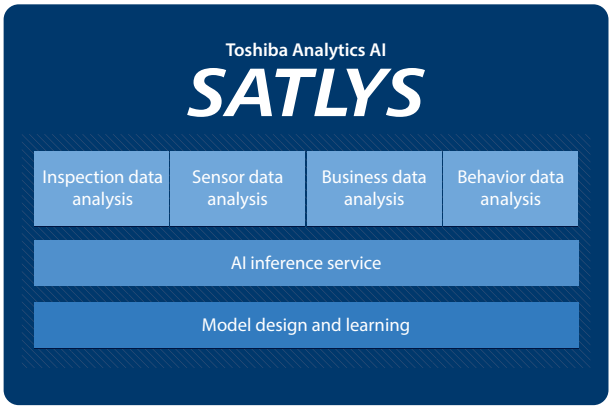
SATLYS consists of a series of steps to analyze a management issue, co-create a new IoT- and AI-based solution, and reform a business model together with the user.

In preparation for deployment, a learning model is designed and AI inference performance is evaluated using sample data extracted by analyzing the management issue. Once the user decides to adopt SATLYS, we proceed with machine learning using large data sets, create an AI inference service environment (cloud or on-premises) according to the user's needs, and provide operation and maintenance services.

SATLYS analyzes data through a series of steps to discover the optimal operating parameters and achieve efficient condition-based maintenance according to the equipment conditions.



Positioning of SATLYS in SPINEX, Toshiba's IoT architecture



Analytics AI services provided by SATLYS

Analytics AI Technologies for SATLYS

Toshiba Digital Solutions Corporation has consolidated its analytics AI technologies into its suite of SATLYS services to support its SPINEX IoT architecture.

SATLYS analyzes big data from IoT using state-of-the-art deep learning and other AI technologies to provide highly accurate identification, prediction, factor estimation, anomaly detection, failure sign detection, human behavior estimation, and other functions.

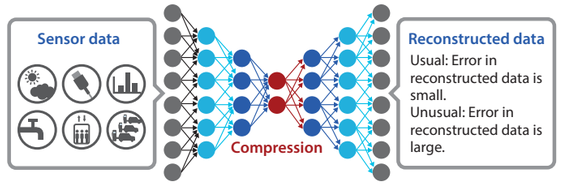
The features of SATLYS include the following:

- large-scale image classification and analysis of big data with tens of thousands of dimensions
- highly accurate inference from small learning data sets
- intuitive explanations through visualization of abnormal factors.

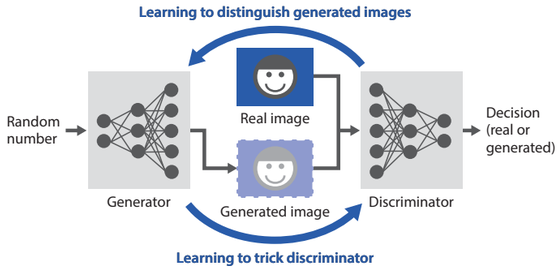
Yokkaichi Operations of Toshiba Memory Corporation has used SATLYS for machine learning to learn and make defect factor estimation from a huge volume of inspection data related to semiconductor manufacturing. As another example of the application of SATLYS, at the Lazona Kawasaki Toshiba Building, a deep-learning methodology known as an autoencoder learns from data collected by 35 000 sensors to detect any unsteady state of the building and estimate its cause.

SATLYS is also used for image inspections of power transmission lines to improve the performance of anomaly identification. Generative adversarial networks (GANs) are employed to automatically generate learning images for additional learning. Anomalies can be detected by showing AI-identified factors on the images of transmission lines.

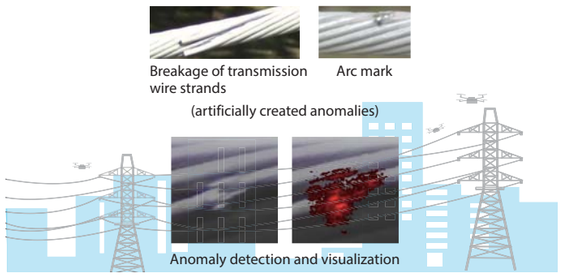
Moreover, SATLYS has been utilized to estimate and visualize human behavior during picking operations at a warehouse, learning from acceleration data collected from operators' wearable devices. The work process was consequently reviewed, increasing picking efficiency at the warehouse by 15%.



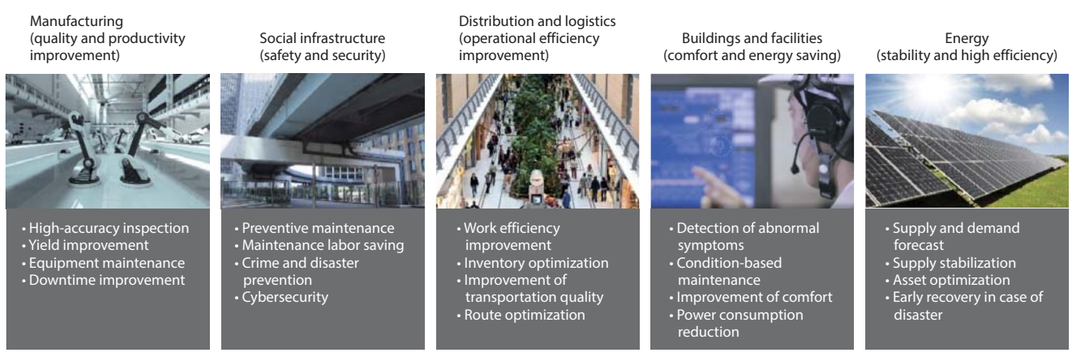
Anomaly detection in big data through extraction by autoencoder



Learning data augmentation using GANs

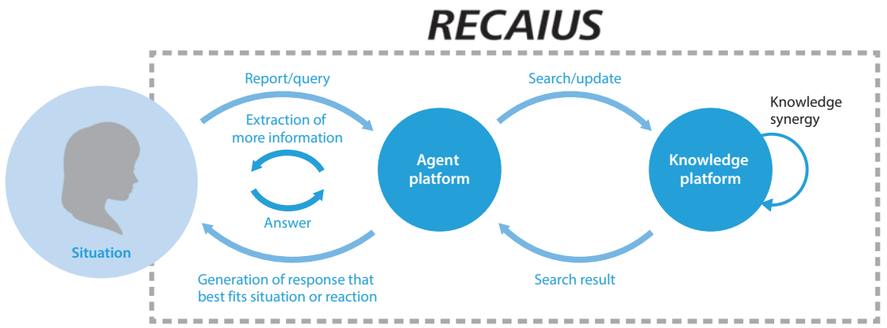


Anomaly detection and visualization of power line using deep-learning technology



Fields of application of SATLYS

New Services of RECAIUS Toshiba Communication AI for Streamlining Customer Service and Support



Overview of RECAIUS

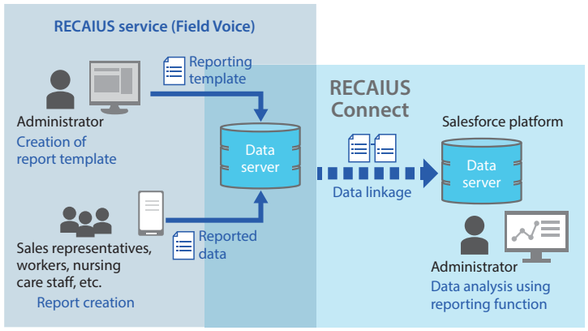
In October 2015, Toshiba Digital Solutions Corporation launched its RECAIUS Toshiba Communication AI service based on media intelligence. Media intelligence encompasses media processing and knowledge-based technologies including speech recognition, speech-to-text, interaction, and image recognition. In 2017, we accelerated the launching of RECAIUS services to support customer contact and field work.

RECAIUS Connect enables collaboration between RECAIUS and the Salesforce customer relationship management (CRM) cloud platform with more than 100 000 subscribers worldwide. RECAIUS Connect supports speech input, efficiently collects feedback from field sites to improve reporting tasks, and visualizes information for worksite improvement.

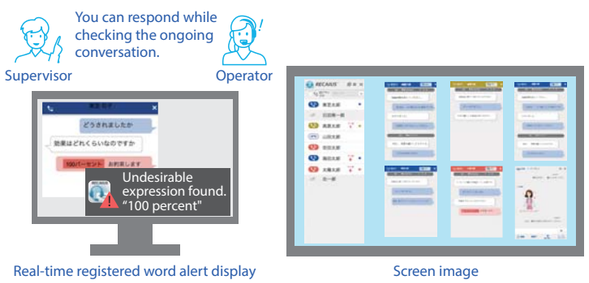
RECAIUS Call Agent is a service that automatically responds to customer phone inquiries made in natural human language to facilitate contact center services and reduce customers' waiting time.

RECAIUS Contact Center Plus can convert speech input from call center conversations into digital text in real time so that operators can respond to customers while referring to dialog text. This service helps to reduce the workload for journal entries, improve the efficiency of response management, and visualize operations at call centers.

RECAIUS will continue to contribute to workstyle innovation in various contexts, by understanding the situation surrounding people based on various data and information generated through business activities and providing effective feedback to both systems and people.

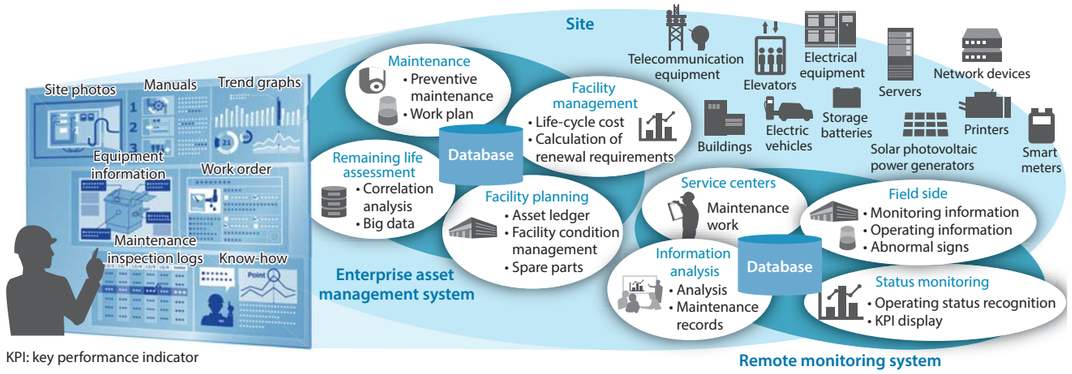


Collaboration of RECAIUS Connect and RECAIUS Field Voice



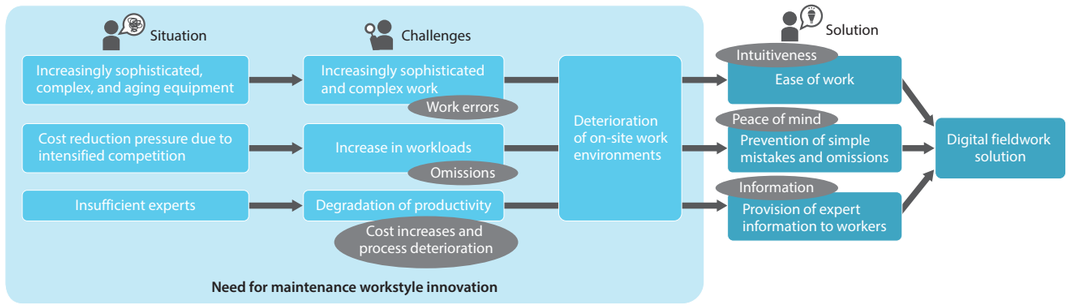
Functional overview of RECAIUS Contact Center Plus

Tablet-Based Digital Solution to Support Field Maintenance Work



KPI: key performance indicator

Concept of digital fieldwork solution using tablets



Development goals of digital fieldwork solution

The working environment for field facility and equipment maintenance is deteriorating. In addition to increasing workloads due to progressively sophisticated and complicated equipment as well as outdated equipment, the problem is being compounded by a number of other factors including the aging of experienced technicians, difficulty in passing expertise to the next generation, and requirements for workforce and process timeframe reductions due to growing cost pressures. To help field maintenance technicians improve their way of working, Toshiba Digital Solutions Corporation has developed a tablet-based digital fieldwork (DFW) solution.

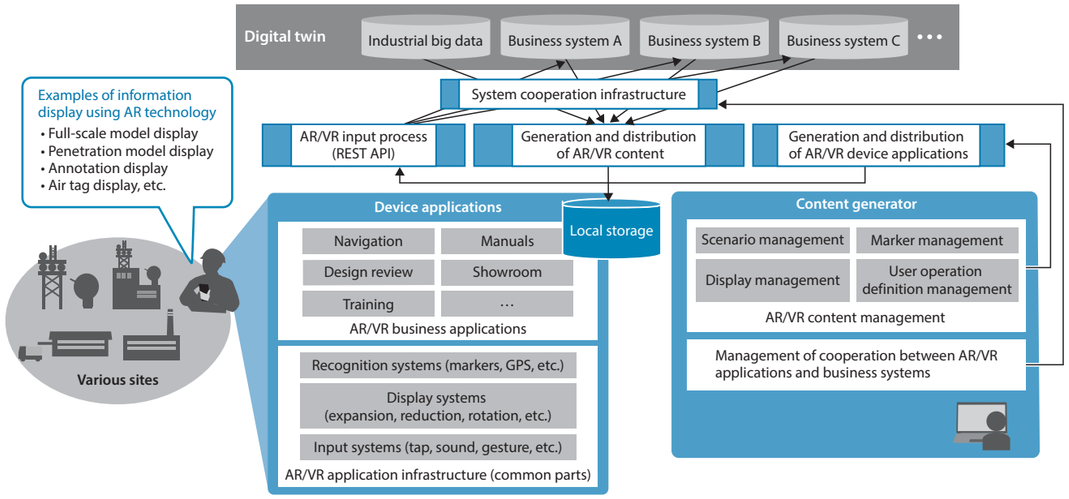
We implemented user experience (UX) techniques to observe actual field maintenance work being performed in order to identify problems. Our observations revealed that maintenance technicians tend to gather information related to the work at hand after they have arrived at the worksite with a large volume of documents. They also may need to squeeze into narrow spaces to check how the targeted equipment is working while performing maintenance. They consequently have to write a report within a limited amount of time.

To resolve all of these issues, our tablet-based DFW solution provides an intuitive information display screen that consolidates all information related to the maintenance work being performed, including drawings, manuals, the operating status of and alerts from the equipment, and technical know-how. The inspection input screen offers intuitive yet reliable means of maintenance. Its history data view makes it easy to recognize outliers and incorrect data inputs, while the guide function highlights the parts to be inspected on an image of the equipment.

Due to the digitization of field data and our knowledge and expertise accumulated over many years, our DFW solution will help to improve not only the work of field technicians but also asset management.

Examples of information and inspection checklist displays

Industrial AR Solutions



REST API: representational state transfer application programming interface
GPS: global positioning system

Overview of industrial AR solutions

Augmented reality (AR) and virtual reality (VR) technologies have rapidly come into widespread use for entertainment applications, particularly in the gaming industry. In addition, these technologies are beginning to attract attention for manufacturing and other industrial applications.

The Toshiba Group has been developing AR technologies, drawing on three-dimensional (3D) technologies such as computer-aided design (CAD) and simulation technologies such as computer-aided engineering (CAE) cultivated through its experience in manufacturing.

AR technologies can be used to project an image of a 3D model in a real space and superimpose annotations to show work procedures and cautions on a real object. In addition, we have conducted proof-of-concept (PoC) testing for various scenes of usage, including sales, proposals, operation and maintenance, design, and manufacturing.

As a result of these activities, we have commercialized a packaged product containing business applications that can be used on mobile, wearable, and other devices; content generators that can create and edit these business applications without any programming; and use-case models.

Our next step is to incorporate them into our SPINEX IoT architecture to visualize the information by means of digital twins in an innovative way and provide links with various business systems in order to support customers' digital transformation.

Full-scale model display

Computer graphics and 3D CAD models are displayed as if they were right at hand in order to allow viewers to grasp scenes, appearances, sizes, etc.

Application examples:
• Landscape simulation
• Placement reviews
• Digital mock-up displays
etc.

Penetration model display

3D CAD models are superimposed on a real object to show internal structures and failure locations.

Application examples:
• Maintenance support
• Advertisement of products
• Work support
etc.

Annotation display

Annotations are superimposed on a real object to show the positions to work on, work procedures, and hazardous spots.

Application examples:
• Maintenance support
• Education
• Product manuals
• Operating instructions
etc.

Air tag display

Messages are recorded and displayed by setting arrows and tags in a real space.

Application examples:
• Navigation
• Work support
• Education
etc.

*Screenshots of this product applied to Japanese market

Examples of application of industrial AR solutions

TOSHIBA REVIEW Science and Technology Highlights
is published annually by Toshiba Corporation.
