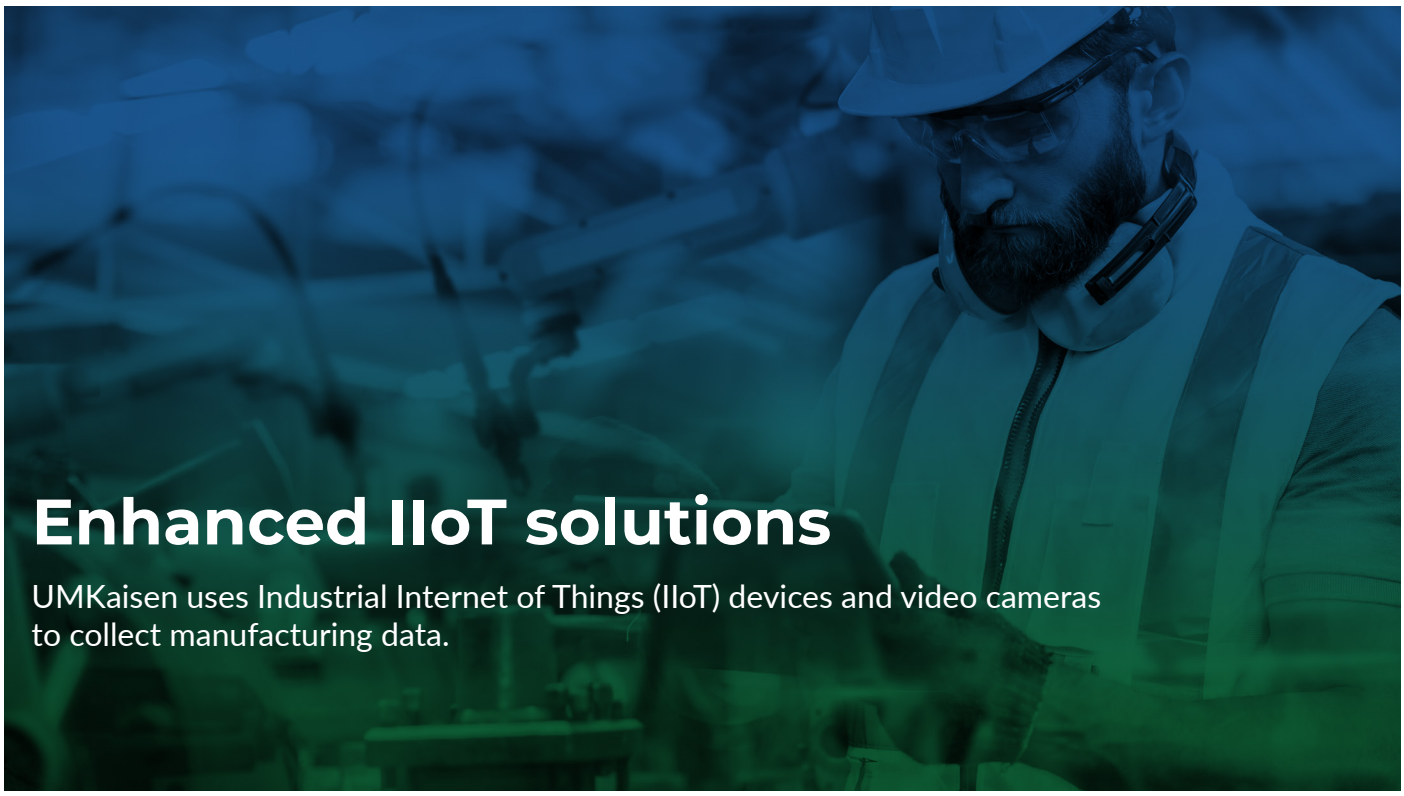
SOFTWARE IMAGING™



Enhanced IIoT solutions

UMKaisen uses Industrial Internet of Things (IIoT) devices and video cameras to collect manufacturing data.

Project objectives: this was divided into two phases. Implement functional enhancements and then move the deployment from being on-premise to a hybrid deployment incorporating the cloud.

UMKaizen is an IIoT platform that solves manufacturing problems through continuous improvement. Two key manufacturing resources, people and technology can be optimized through the ongoing collection and analysis of manufacturing data. UMKaizen connects technology such as machines, robots, and IoT devices and then collects and consolidates data.

It also provides fully automated Cycle Time collection, machine monitoring, data analytics and leads the factory to make better decisions. Strong Integration capabilities enables the collection and analysis of data from sources external to the Ultimate Manufacturing Platform.

Key Points:

- Enhance the existing manufacturing solution
- Use **Industrial Internet of Things (IIoT)** devices and video cameras to collect manufacturing data
    - Data that can be analysed to **identify abnormalities** in the production process
    - Video footage from the same point in time that can be analyzed to **identify the cause**
    - Corrective action (Kaizen) to **implement improvements**
- Solution is **deployed** to manage multiple production lines in multiple factories in multiple countries across SE Asia

UMKaizen

Phase 1: Functional enhancements

Extend the camera capability:
- Original video capability was for one camera per 'work station'. This was extended to multiple cameras, which enabled a more detailed view of activities.
- Access to video data required both the business logic and the UI to enable access to multiple sources.

Extend the analytics of manufacturing Cycle Times (CT) and Machine Times (MT):
- Implemented benchmark times, to enable the modelling and comparison of actual measurements against multiple scenarios
- Extended dashboards to visually display actual vs modelled times

Implement a 'Query Dashboard' for recorded data:
- Online BI tooling enabling the display of manufacturing data online
- Data export functionality for use with external tools, capable of large volumes of manufacturing data

Comments and Notes recording:
- Enable the storing of comments and notes, linked to a specific point of time for each MT/CT record
- Comments had to be multi-language capable to support the multiple languages used at the various manufacturing sites

Dashboards to visualize production volume data:
- Several dashboards were extended to display additional manufacturing metrics, including Overall Equipment Effectiveness (OEE), production line and shift effectiveness and comparison against production targets.

Phase 2: Hybrid deployment

Monitoring activities at a local level remain on-premise, the principle reasons being dependencies on some recording and monitoring IoT devices requiring 'edge processing' of data, and the reliability of 24x7 internet connectivity.

Consolidation of data on the cloud
- The automated transfer of manufacturing data from multiple lines across multiple factories
- Automated data cataloging and management determined by the source/original factory and production line
- Automated data archiving and purging

Security and authentication enhancements
- Functionality to ensure the data transfer to the cloud is secure and successful.
- The user management functionality was extended to include additional roles, and new functionality for user management
- Upgraded technologies to newer versions of software ensure data and network security.
- A new user interface to support the application licensing model, which was revised for the new cloud capability

Additional Logging and Error Handling
- Logging for user management and licensing activities
- Logging of user access, and a query mechanism to review and analyze access activities

Points about both phases

- The Software Imaging Ltd (SIL) development team worked closely with a development team in Japan, overcoming obstacles such as timezones, some language barriers, etc.
- SIL's agile development approach was new to the customers development team, but through collaboration, they embraced the methodology
- SIL set up a continuous development and integration (CI/CD) environment which was shared with the remote development team
- The application is deployed in multiple countries throughout SE Asia, therefore the application was required to be fully multilingual, compliant with Unicode (UTF-8) standards
- Testing could have been a challenge due to language challenges with testing data, but the experience of SIL enabled a successful project

Future plans

Currently investigating the idea of a 100% cloud solution, removing the edge deployment entirely:

- Primary reason would be to simplify the deployment and any subsequent maintenance as the initial deployment and any updates would be centrally managed. The solution is currently used in a number of factories around SE Asia, some are in remote locations without local IT staff
- Local, edge hardware seems to be sensitive to technical issues from power outages and surges
- Motion Analysis using Artificial Intelligence and Machine Learning can provide additional data to extend the analytical capabilities of the solution. (Cloud could be considered mandatory for ML projects due to data volumes and the processing of the machine learning)

Architectural changes to enhance 'big data' capabilities:

- Manufacturing operations running 24x7 can generate vast amounts of data, especially when combined with video data. A number of changes are being considered to optimize the access of stored data
- Although data can be feely accessed with 3rd party BI tooling, additional reporting dashboards will be included with the solution to reduce the requirement (and therefore the cost) of 3rd party software

Technology details

- Main tools: JavaScript UI using external libraries, Microsoft .Net Core and the PostgrSQL database, managed in MS DevOps.
- Key integration points: RestAPIs to a number of external systems. IoT device connectivity using IoT Data Server from Denso Wave.
- Deployment: Deployment independent. Deployment sites are using either MS Windows and/or Linux. Cloud providers are MS Azure and Google Cloud Platform (GCP). All client/user access is

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