L&T Technology Services

INTEGRATED MCARE
CONDITION BASED MAINTENANCE

NEED OF THE HOUR

Businesses can no longer afford sudden losses of productivity and capital due to unplanned machine breakdowns. The typical lifetime of any equipment ranges from 10 to 15 years. Traditional techniques and spot solution models used by most organizations for maintenance are unable to leverage the right metrics to monitor machines and in turn, fail to predict equipment health and life correctly. The lack of historical data for future analysis also makes it difficult for existing solutions to identify faults that are most likely to happen for a specific equipment. There is therefore a strong need for a model that can accurately predict the health and performance of an equipment through monitoring the right metrics and utilizing historical fault information for machine-specific analysis.

LTTS SOLUTION

L&T Technology Services (LTTS) offers Integrated MCare, a best-in-class equipment maintenance solution that employs machine learning principles in predictive analytics to proactively notify operators about potential machine failure. The solution simulates data using the Digital Twin approach to compensate for missing historical information. Our domain expertise and experience ensures that the credibility of the simulated data remains intact. The constantly evolving fault signature libraries further allow the solution to predict faults that have never occurred in the past. The libraries come with fault data that has been captured, processed, and analyzed on live running systems over several years. This AI-powered model is validated in an accelerated life test under controlled conditions, ensuring high accuracy in fault prediction.

- Capture real-time data
- Hybrid approach (Digital twin + data models)
- Reduce data latency
- Fault signature libraries for different equipment types
- Predict and prevent possible component faults
- Access actionable intelligence
- Accurately identify MTTF & MTTR
- AI based models for asset life prediction
- Ensure remote monitoring of equipment
- Integrate with existing solution

DIFFERENTIATORS

LTTS' Integrated MCare solution is an advanced predictive maintenance offering in the market. This end-to-end solution for condition-based monitoring of critical process equipment comes with an industrial grade edge gateway, analytics component, intuitive dashboards, and AI/ML algorithms for motors. The solution uses:

- A robust hardware with high speed real-time data capture and multiple I/Os that can input data from virtually any source
- AI edge analytics models
- A digital twin approach
- User-friendly dashboards and visualization application with widget-based architecture

Key features of the solution include:

General	
Dimensions (mm)	200x150x100
Weight(g)	800
Temperature Range	-25°C to 85°C (Industrial grade)
Operating Voltage	24 VDC, 110/230 VAC / 50Hz / 60Hz
Data Collection	Continuous data acquisition as and when required
Hardware	
Processor	Quad Core 1.2 GHz 64 bit CPU
RAM	1 GB
Internal Storage	32 GB
Certification	IP67, IP65 compliant
LED Indications	3 LEDS (Health, Alert, and Power)
Signal Conditioning	12-bit ADC
Memory	1 GB DDR3 RAM
Storage	64 GB Micro SD Card
Mounting Bracket	DIN Rail Mount
Security	128/256 AES
Input/Output	Refer to the Input/Output Table below
Mechanicals	Standard Enclosure - Polycarbonate (IP66), Metal Enclosure (IP67)
Software	
Operating System	Linux
Connectivity	
Ethernet 10/100 Mbit/s (Down link)	✓
Wi-Fi	✓
4G/LTE	✓
CAN	✓
BACnet	✓
J1939	✓
BLE	✓

Sensors	
Vibration (Single and Tri axis)	✓
Acoustics	✓
Temperature	✓
Pressure	✓
Flow rate	✓
Airflow	✓
Oil Quality	✓
Current	✓
Package	Edge Gateway (Industrial grade)
	Server Analytics Component (AI/ML enabled) Web Portal/Dashboard
Data Analytics	On board pre-processing and comprehensive analytics with on premise server
Dashboards	Published on enterprise server and cloud
Pricing	License-based pricing

Input/Output Table

Analog Input (XXX)	
1 : 0-10 VDC	02 : 2 Channels
	04 : 4 Channels
	08 : 8 Channels
	16 : 16 Channels
2 : 4-20mA	02 : 2 Channels

Digital Input (XXX)	
1 : 24 VDC	02 : 2 Channels
	04 : 4 Channels
	08 : 8 Channels
	16 : 16 Channels
2 : 110VAC	02 : 2 Channels
3 : 230VAC	02 : 2 Channels
	04 : 4 Channels
	08 : 8 Channels
	12 : 12 Channels
	16 : 16 Channels

Digital Output (XXX)	
1 : 24 VDC	02 : 2 Channels
	04 : 4 Channels
	08 : 8 Channels
2 : 24 V (open collector)	02 : 2 Channels
	08 : 8 Channels

Faults	
Misalignment	Bent Shaft or Angular Misalignment
	Offset/Parallel Misalignment
	Combination Misalignment
	Belt/Pulley Misalignment
	Gear Problem
Bearing Defect	Adapter Sleeve Looseness
	Axial Play
	Axial Thrust
	Improper fit with Housing
	Cage Inaccuracies
	Increased Clearance
	Oil Whirl
	Improper Fit with Shaft
Mechanical Looseness	General Looseness
	Mechanical Bearing Looseness
	Cracked Foundation or Structure Mechanical Looseness
	Mechanical Looseness - Bearing Looseness
	Mechanical Looseness - Cracked Foundation and Structure

Electrical Problem	Stator Eccentricity
	Rotor Eccentricity
	Cracked Rotor Bar
	Loose Rotor Bar
	Phasing Problem
	Torque Pulses
	Magnetic Center Deviation
Belt Problem	Worn, Loose or Mismatched Belts
	Eccentric Pulley
	Belt Resonance
Gear Problem	Eccentricity
	Tooth Wear
	Cracked/Broken Tooth
	Backlash
Rotor Problem	Rotor Rub
	Unbalance on Overhung rotor
	Unbalance on simply supported rotor
	Eccentric Rotor
Hydraulic Problem	Hydraulic and Aerodynamic Forces
	Hydraulic and Aerodynamic Forces - Flow Turbulence
Others	Worn, Loose or Mismatch Belts
	Wear/Clearance Sleeve Bearing Defect
	Sleeve Bearing Defects - Wear/Clearance Problem
	Resonance

BENEFITS

LTTS' Integrated MCare enables plant operators to:

- Gain actionable insights in real time, with AI/ML analytical models operating at dual levels, both edge and server
- Detect potential machine faults early on, before incident occurrence or major equipment damage with round-the-clock monitoring
- Leverage feature-rich fault signature libraries developed with simulation as well as real-time equipment
- Save cost, data transmission bandwidth, and storage space at server due to preliminary analysis on the edge gateway
- Drastically reduce maintenance cost, which includes the price of repair and spare part storage
- Integrate the solution with existing hardware and software, along with SCADA systems
- Ensure safe remote monitoring with a secure and connected network

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ENGINEERING **THE CHANGE**

Customer Success Story

Keppel Data Centres

Keppel Data Centres (KDC) is part of the Keppel Group. KDC owns, operates & manages 13 premier Data Centres in Europe & APAC. KDC sought for Predictive Maintenance solution to counter the high cost associated with unplanned outages due to critical equipment – Diesel Rotary Uninterrupted Power Supply (UPS), Chillers and Computer Room Air Conditioning Units (CRACS).

LTTS iBEMS/MCare powered soln. enables KDC's competitive DC SLAs, manage DC Asset Uptime & ROI.

MCare Solution:

- Azure IoT Hub based soln. enables max. uptime for 22 mission-critical Datacentre equipment (UPS, Chillers, CRACs)
- AI/ML based Predictive Maintenance (PdM), Fault Detection & Diagnosis (FDD) for DCs
- Pre-build Machine Learning Models and Fault signature library for different equipment type
- Tech. stack : Azure IoT Hub, Azure SQL, Azure Time Series Insights Blob Storage, SQL DW, Power BI
- Deal Size – $0.42M (1st D.C) with 13x potential
- Mar 2019
- Singapore

Win Results

~15% Potential Reduction in critical asset failure with advanced prognostics

~20% Potential Reduction in Maintenance Cost with Fault Detection and Diagnostics

~7-10% Potential Impact on Service Levels with increased availability of critical assets