Asset Intelligence System: A Practical Approach for Transforming from Reactive to Proactive Asset Performance Management

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DR. ANANTH SESHAN:

• **20+ Years**: Robotics & Automation, APM, Digital Manufacturing, Plant Reliability.

• **Chairman**: 5G Group of Global Companies.

• **CEO & Managing Director**: 5G Automatika Ltd. (5GA), Ottawa/Mexico.

• **Chairman**: MESA APM Working Group.

• **Board Member at Large**: International Board of Directors, MESA.

• **University of Toronto**: Ph.D., Robotics, ‘92.
CO-PRESENTER INTRODUCTION

MR. MRINAL CHAKRAVARTY:

- **4 Years**: Smart Manufacturing Energy Intelligence.
- **Sales/Marketing**: 5G Automatika, 5G Group of Global Companies.
- **Carleton University**: B. Eng. (Aero), MBA.
- **5GA**: Digital Automation, AIM Software.
ASSET PERFORMANCE MANAGEMENT (APM)

“An approach to managing the optimal deployment of assets to maximize profitability and predictability in product supply, focusing on real margin contribution by asset ..... 

More broadly, it looks at the whole lifecycle of an asset, enabling organizations to make decisions that optimize their operational and financial results by maximising the performance of their assets.” – MESA International [1]
A DEEPER DIVE...

Operational Impact
- Eliminates breakdowns up to 70%
- Reduce downtime by up to 50%
- Reduce scheduled repairs by up to 12%

Financial Impact
- Reduce maintenance costs by up to 25%
- Reduce Capital Investment by 3-5%
- Increase in Average Gross Margin by 55%
- Increase in Average Operating Margin by 18%

Source: Capgemini, 2017 [2]
INDUSTRY DIRECTION

What are the top IIoT use cases your company will start pursuing in the next year?
(N=249, all respondents)

- Remote monitoring: 26%
- Asset reliability: 23%
- Business model transformation, e.g. selling capacity: 22%
- Asset and material tracking: 21%
- Quality monitoring: 21%
- Customer access to information: 20%
- Production visibility: 19%
- Energy efficiency: 18%
- Internet enabled products: 18%
- Traceability and serialization: 15%
- Supplier visibility: 12%
- Improving safety: 8%
- Improving environmental performance: 5%

Source: LNS Research, 2017 [3]
CURRENT STATE OF AFFAIRS

Q: Which of the following maintenance strategies are present within your plant? (n=322;201)

Source: Plant Engineering, 2018 [4]
“APM market will be (a) USD 300B business by 2020 ... 50% of asset intensive organizations will rely on APM for critical asset performance management.” – Capgemini, 2016 [5].
APM ADOPTION CHALLENGES

- Non Value added labor needed
- Lots of data but no Real-Time Intelligence
- No tracking of MTTR in real time
- EAM / CMMS system not integrated
- Shop floor personnel uncomfortable with IT/Enterprise Systems
- Opportunistic maintenance difficult
- Islands of Legacy automation
INTRODUCING ASSET INTELLIGENCE SYSTEM (AIS)

A software that enables the collection of raw data from the plant assets, controllers and drives and convert them into contextual meta data and drive actionable intelligence to CMMS systems and maintenance personnel in real time!

An Enabler of APM!
AIS ILLUSTRATED: STAKEHOLDERS

**PLANT FLOOR**
- Real-Time & Historical Asset Conditions

**Maintenance Personnel**
- Proactive Asset Life/Health Maintenance
- Emerging Failure Conditions, Opportunistic Predictive Maintenance, Opportunistic PMs, Operational Metrics, Job Plans/Dispatch Info, Maintenance reports

**Plant Supervisor(s)**
- Asset Availability/Operational KPIs/Maintenance Status Updates

**AM / CMMS**
- Key Metrics’ Updates e.g. Unplanned Downtime Costs

**Maintenance Supervisor(s)**
- Mobile or Web-Based Approval of Work Orders

**Senior Management**
- Key Metrics’ Updates e.g. Unplanned Downtime Costs
HOW AIS DRIVES APM - OVERVIEW

1. Seamless P2E Integration – Open Standards
2. Acquisition of real-time raw machine data
3. Continuous real-time derivation / aggregation of meta-data from raw data
4. Logical Rules Engine
   - Represent logical conditions as a set of rules
5. Trigger action(s) – conditions found true in real-time
6. Proactive Maintenance Actions

- Predicting future probabilities of machine failure - deep learning algorithm; trigger maintenance
AIS DRIVING APM: OPPORTUNITY 1

• Removal of Non-Value-Added-Labour in Asset Usage Updates
  – Manual meter updates in EAM/CMMS/Plant System.
  – Errors due to Human Fallibility.
AIS DRIVING APM: OPPORTUNITY 2

• **Usage-Based rather than Time-Based PM:**
  
  – Generate W/O actions directly: asset usage crosses a limit.
  
  – Connect multiple lift pumps to EAM/CMMS, aggregate individual usage, automatically create W/O if any > 5k hrs:
AIS DRIVING APM: OPPORTUNITY 3

– Real-Time logical evaluation of an asset condition by AIS. based on its performance e.g. vibration, temperature.
– Generate maintenance actions in EAM/CMMS proactively prevent asset failure or performance degradation.
AUTOMATED CONDITION-BASED PROACTIVE MAINTENANCE

Responding opportunistically and proactively to 2 emerging CNC failure conditions (spindle vibration and temperature) upon crossing a threshold and staying above it for > 5 minutes.
AIS DRIVING APM: OPPORTUNITY 4

• Trends or Rates of Change in Asset Performance:
  – The velocity at which asset performance is changing.
  – Real-Time monitoring w. logical rules engine.
  – Anomalies = Immediate maintenance trigger in EAM/CMMS.
  – Asset operational status-driven APM.
Triggering PdM W/O when the rates of change in any of the glycol pumps’ temperature OR discharge pressure drop are greater than 1.5 times their last 30 minute average values.
VALUE OF AIS

- Reduced Unplanned Downtime
- Unified Visibility
- Improved Maintenance Effectiveness
- Reduce Regulatory Risks
- Increase Return on Assets!
- Vertical Integration
- Improve MTBF
- Removal: Non-Value Added Labour
- Reduce MTTR
THE FUTURE OF AIS

Use of connectivity technologies and big data analytics is set to increase dramatically:

<table>
<thead>
<tr>
<th>Service Type</th>
<th>In Use Today</th>
<th>Change Over the Next Five Years</th>
<th>In Use in Five Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predictive Maintenance</td>
<td>28%</td>
<td>+38%</td>
<td>66%</td>
</tr>
<tr>
<td>Big data driven process and quality optimisation</td>
<td>30%</td>
<td>+35%</td>
<td>65%</td>
</tr>
<tr>
<td>Process visualisation/automation</td>
<td>28%</td>
<td>+34%</td>
<td>62%</td>
</tr>
<tr>
<td>Connected factory</td>
<td>29%</td>
<td>+31%</td>
<td>60%</td>
</tr>
<tr>
<td>Integrated planning</td>
<td>32%</td>
<td>+29%</td>
<td>61%</td>
</tr>
<tr>
<td>Data-enabled resource optimisation</td>
<td>52%</td>
<td>+25%</td>
<td>77%</td>
</tr>
<tr>
<td>Digital twin of the factory</td>
<td>19%</td>
<td>+25%</td>
<td>44%</td>
</tr>
<tr>
<td>Digital twin of the production asset</td>
<td>18%</td>
<td>+21%</td>
<td>39%</td>
</tr>
<tr>
<td>Digital twin of the product</td>
<td>23%</td>
<td>+20%</td>
<td>43%</td>
</tr>
<tr>
<td>Autonomous intra-plant logistics</td>
<td>17%</td>
<td>+18%</td>
<td>35%</td>
</tr>
<tr>
<td>Flexible production methods</td>
<td>18%</td>
<td>+16%</td>
<td>34%</td>
</tr>
<tr>
<td>Transfer of production parameters</td>
<td>16%</td>
<td>+16%</td>
<td>32%</td>
</tr>
<tr>
<td>Modular production assets</td>
<td>29%</td>
<td>+7%</td>
<td>36%</td>
</tr>
<tr>
<td>Fully autonomous digital factory</td>
<td>5%</td>
<td>+6%</td>
<td>11%</td>
</tr>
</tbody>
</table>

AND....

Attitudes of Reliability and Maintenance Professionals on IIoT Predictive Analytics (9-Point Scale)

<table>
<thead>
<tr>
<th>Statement</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility staff recognize the potential of IIoT Predictive Analytics</td>
<td>4.4</td>
</tr>
<tr>
<td>We are delaying new investments in Predictive Analytics until we decide on an IIoT strategy</td>
<td>4.9</td>
</tr>
<tr>
<td>Adopting Industry 4.0 is a priority for our organization or facility</td>
<td>4.9</td>
</tr>
<tr>
<td>The hype over Industry 4.0 and IIoT is exaggerated</td>
<td>5.2</td>
</tr>
<tr>
<td>Senior executives recognize the potential of Predictive Analytics</td>
<td>5.3</td>
</tr>
</tbody>
</table>

Source: Emory University Future of IIoT Research Study and Presenso.
THANK YOU!
BIBLIOGRAPHY

7. https://www.presenso.com/blog/emory-research