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HOW IOT ENABLED EAM CAN IMPROVE OVERALL EQUIPMENT EFFECTIVENESS – A CONCEPTUAL SOLUTION

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Abstract

In case of manufacturing industry, revenue generation is directly dependent on productivity which intern is greatly influenced by overall equipment effectiveness of the manufacturing equipments. Manufacturing companies are always looking for new ways to improve overall equipment effectiveness and reduce the operational cost. Enterprise Asset Management processes and systems delivers this benefit of improving OEE. But, current revolution in the industry due to Internet of Things have advanced the EAM to a whole new level and uncovered new avenues to get insights about improvement in overall equipment effectiveness of equipments. This article discusses a conceptual solution - IoT enabled EAM to help solve a manufacturing industry challenge around overall equipment effectiveness and productivity. The article first talk about a specific use case for welding equipments used in body shop, associated productivity related challenges and then provide a technological approach to explain how an IoT and EAM based solution

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can leverage existing information from various data sources to gain important predictive and prescriptive insights which can to help solve the problem.

1. Introduction

The client is a major US based automobile manufacturer having global presence throughout the world and one of the fortune 500 companies. Some of the major challenges the client is experiencing are revenue loss due to decreased throughput, high maintenance cost & low availability of equipments. Client is interested in improving three of their matrices called PPU (Productivity Per Unit), HPU (Hours Per Unit) & CPU (Cost per unit). Also, other competitors are exploring various solutions based on IoT and advanced technologies to gain an edge in the market and hence client is also motivated to find new ways to bring about business benefits.

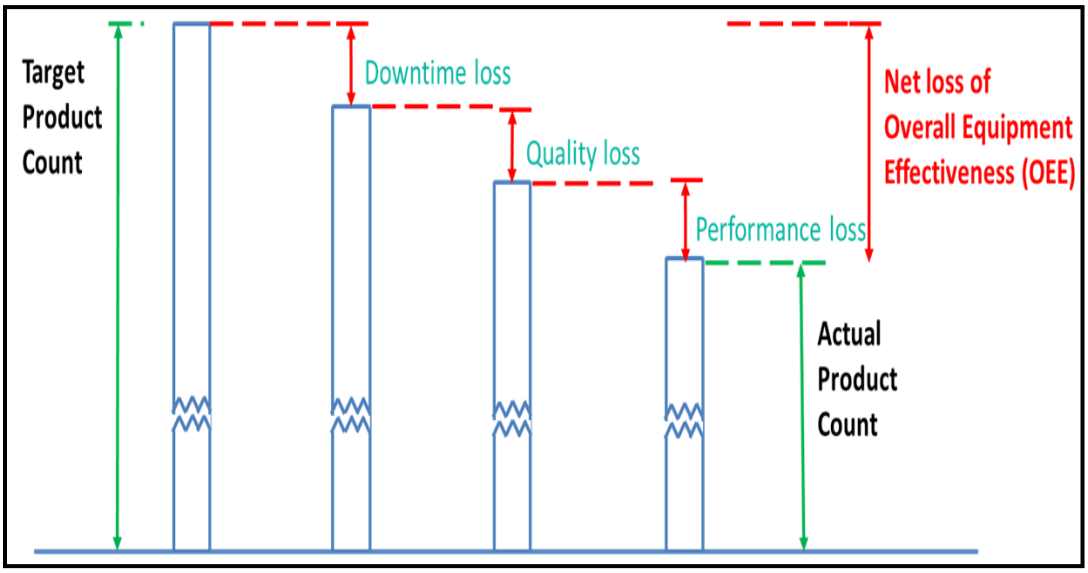
2. Scenario

The client's situation is like this. The client has sensors attached to equipments to detect equipment conditions such as pressure gauges, temperature gauges and vibration measuring devices. There are also PLCs and controllers being used for automation and process control. These devices and sensors generate enormous amount of data about equipment and process. There are systems such as EAM systems, MES system, Quality Systems which are used to capture various type of information. All this data and information are used in isolated way and only for specific purpose. There is a great opportunity to look at all the various types of data holistically and in relation to one another, to find areas of improvement which are not obviously apparent otherwise.

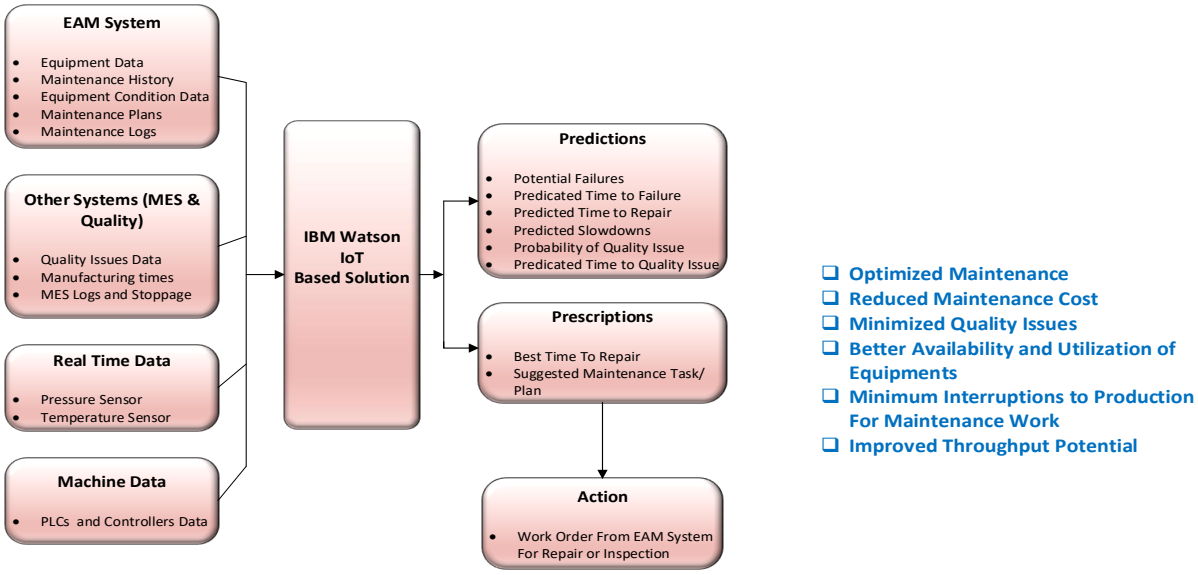
3. Use Case

For that purpose, a specific use case is discussed here to describe the conceptual solution.

The client has various welding stations within body shop. The welding stations have automated welding equipments that performs spot welding on the car door. The sequential process is controlled by weld controllers and PLCs and spot welding equipments have sensors attached them to measure the temperature of the welders. The car body doors are moved from station to station by hydraulic conveyors. The conveyors have pressure gauges attached to them to measure hydraulic pressure. Ideally, each welding station line should produce around 23-25 doors per hour of time. But, the welding station line is typically not able to meet this number and produces less no. doors (19-21 avg.). There are also doors not welded properly and fails to meet the quality criteria, resulting in defective product and lost production. To ensure the quality, regular inspection of all welding stations needs to be done through preventive maintenance programs which adds to the non-productive time. This impacts hours to produce, cost to produce, productivity per unit metrics.



As shown in above figure, the product count reduction is directly related to reduced overall equipment effectiveness.



(OEE). The overall equipment effectiveness is impacted by availability loss due to downtime, performance loss due to equipment condition, quality loss due to defective part production. The improvement in these areas can improve the OEE and hence the production rate.

4. Solution

Provide a statement that what is expected, as stated in the "Introduction" chapter can ultimately result in "Results and Discussion" chapter, so there is compatibility. Moreover, it can also be added the prospect of the development of research results and application prospects of further studies into the next (based on result and discussion).

Now, let's see how EAM & IoT can bring such improvement.

This would require leveraging following data that are captured by the various client systems.

- Real time data - Generated by temperature sensors connected to welding equipments and pressure sensors connected to hydraulic conveyors, PLCs used to automate the process.
- EAM Data (e.g. IBM Maximo) – Equipment Data, Equipment Locations data, Downtime data, Maintenance history data related to welding stations.
- MES and Quality related data – Logs, stoppages, quality issues.
- Machine Data – PLCs and Controller's data.

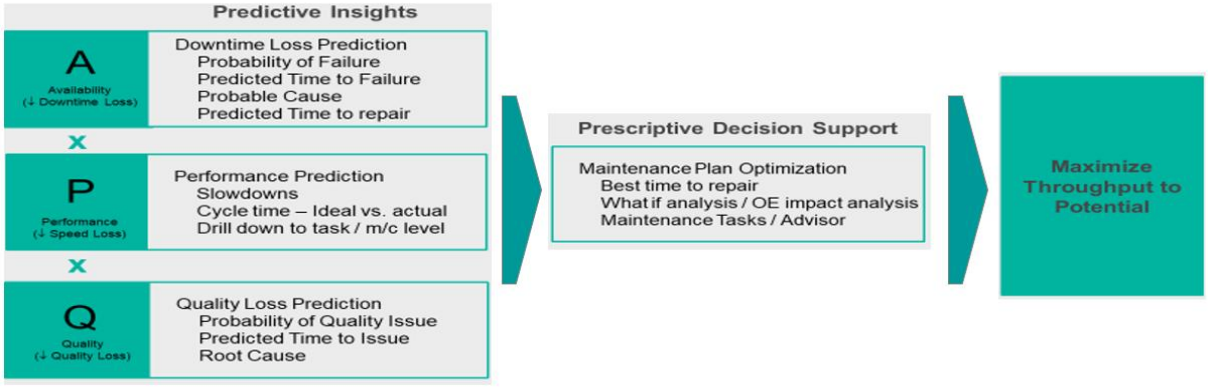
Data from above sources can be sent to IoT platform such as IBM Watson IoT. IoT platform allows to establish secure connection with the data sources, ingest data from all sources, aggregate and store the data. It allows looking at the data from various sources in relation to one another and identify patterns that can lead to import insights about the situation.

Here in the case of this weld station related use case, IoT solution can relate the pressure data provided by pressure gauge connected to hydraulic conveyors to various other history maintenance data or downtime data and pressure reading at that time to predict the probability and timing of potential functional failure or degraded performance which can slow down the line or even stop the line completely.

IoT Solution then can provide the recommended repair plan and action, and best time to repair by looking at data related to maintenance plans, manufacturing operations schedules and OEE impacts. Based on this information, with a click of a button, work orders can be generated for further inspection or repair from EAM system such as IBM Maximo seamlessly. The potential functional failure or degraded operation of equipment can be corrected before it can occur. The maintenance work can be planned in such a way that it can have minimum disruption to production operations. This ensures desired availability and performance of the equipments, avoid any unnecessary PMs and interruptions to production.

Similarly, IoT solution can look in to the temperature data coming from sensors connected to welding equipments, weld quality problems from quality systems, production data from MES, put them in context and understand relationships between weld temperature and quality problems. It can provide probability of quality issue and predicted time for issue. Based on prescribed remedial plan and action, necessary work order can be generated in Maximo. This will reduce no of the failed or defective units as the quality related issues will be addressed before they can occur.

The below figure shows various predictions possible related to Availability, Performance and Quality losses. Not only predictions, this solution can also enable prescriptive decision support by providing recommendations around maintenance plan optimization or suggested action in the form of work order form an EAM system to prevent or mitigate the problem.



4. Conclusion

This way, the IoT Solution can address all three aspects Availability, Performance & Quality to increase OEE which directly results in better throughput potential. It helps optimize the maintenance plans, reduce maintenance time and maintenance cost. It also reduces lost production due to quality problems.

Overall, it reduces the cost per unit, hours per unit and increases productivity per unit which is the main business objective from such an initiative.