In Field Predictive Maintenance

Abstract

Knowing in advance when an equipment will fail, avoids both unplanned and planned downtimes. Next-gen maintenance will increase equipment up-time by over 20%, reduce maintenance costs by 25%. A large part of industry 4.0 installation, machinery and vehicle operates in **austere environments with no access to internet or electricity**. Traditional solution for predictive and diagnostic solution fails without these two utilities.

Our company AITS has developed a streamlined approach to implement AI based predictive maintenance algorithms directly on the edge devices with in-field data to deploy capability. This allows customers to bring autonomy to the edge devices, and enable low power use cases even without network connectivity.

Problem statement

American industries continue to spend over $1T in critical equipment maintenance costs that ballooned to over $2.1T by 2020. Somewhere between one-third and half of these maintenance $s were wasted through ineffective maintenance management methods. Industries can no longer absorb this level of inefficiency. The main reason for this level of inefficiency is lack of quantifying data based on which maintenance decisions and operations are scheduled. Maintenance has the potential to save the Department up to $5 billion annually [3]. This is based on AI analytics-based prediction and marks a new way of implementing maintenance at an industrial scale.

Industry 4.0 predictive maintenance solutions have been using data-center (internet or on-premise network) as a ready infrastructure. Traditional predictive maintenance approaches stop working on vehicle, equipment and machinery in motion without reliable connectivity. Moreover, a single application is deployed on thousands of machines disregarding the condition indicators of individual sites and machines.

Need & Background

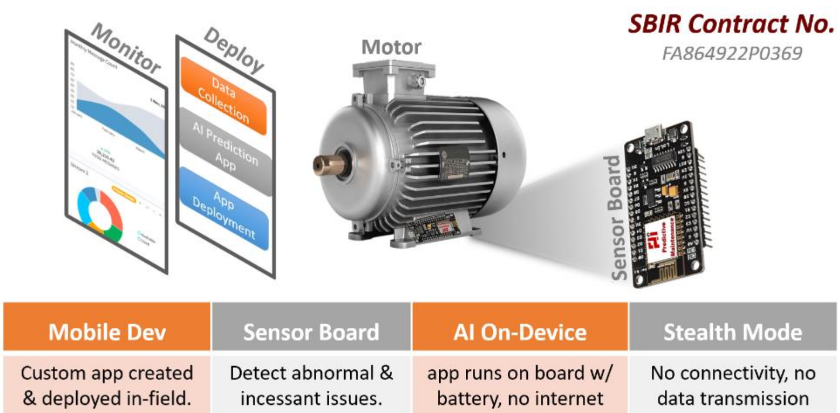
Typically, organizations do not track equipment performance, maintenance tasks performed, failure history or any of the other data that could, and should, be used to plan and schedule tasks that would prevent premature failures, extend the useful life of critical plant assets and reduce their life cycle cost. Instead, maintenance scheduling has been, and still is, determined by equipment failures or on the perceptions of potential failure by maintenance personnel who arbitrarily determine the type and frequency of routine maintenance.

In addition, the general opinion has been “Maintenance is a necessary evil” or “Nothing can be done to improve maintenance costs”. Perhaps these were true statements 10 or 20 years ago. However, the development of microprocessors, sensors and advancements in the field of Artificial Intelligence systems provide the means to optimize maintenance effectiveness.

Maintenance costs are typically a major portion of the total operating costs of most industrial plants. Industrial sector primarily uses either run-to-failure or preventive maintenance methods.

Solution

In Field Predictive maintenance - is a condition-driven preventive maintenance solution that is designed to work with low devices on equipment in situ at remote/electricity/internet devoid locations for the machinery and equipment. End to end "In Field Predictive Maintenance" solution includes a mobile device with touch screen and a sensor board. Sensor board is mounted on motor/equipment and connected to mobile device to gather sensor data specific to the motor/equipment.



Mobile device is connected to a sensor-board on motor/equipment with USB or BLE protocol to receive sensor data, train/test AI model, compile and deploy firmware to monitor health. Our solution provides high value to machinery and equipment operating in austere environments since it runs on battery and requires no Internet connection. By accurately predicting the actual failures, we can achieve maintenance cost reductions, increased productivity, and efficient utilization of budget and resources.

AITS solution uses machine learning to optimize maintenance schedules and provide analysis and recommendations at both a component and system level. It is capable of integrating historical structured (e.g., sensor reports) and datasets.

Applications

Deep learning analysis of vibration's hormonic is critical to monitoring the health of many equipment including the ones shown in table below.

Air Pump	Turbine	Conveyor Belt	Air Conditioner	Boiler Burner
Generator	Air Filter	Transformer	Vibration Table	Brewing Engine
Air Compressor	Cold Room	Mixer	Vacuum	Elevator
Re-fusion Oven	Water Pump	Gearbox	Cryo Pump	...

Table: Equipment suitable for vibration based 3health monitor

It can detect faults like unbalance, misalignment, bearing issues, looseness, gear problem, bent shaft, cracked shaft, damaged rotor bar and many more.

Differentiators

The solution is designed for industry 4.0 machines and equipment installed in austere environment with no access to electricity and Internet.

1. Non tech user can deploy the solution with few touch buttons in a matter of minutes.
2. End to end "In Field Predictive Maintenance" solution is created, deployed and used in the field.
3. Runs with no-cloud or no-Internet connection.
4. Sensor board firmware is customized for each motor/machine in the field leading to higher accuracy.
5. Low energy solution runs on battery for several months.

Conclusion

While traditional methods of predictive maintenance continue to reduce cost and improve schedules of machinery, last mile coverage of our "In-field Predictive Maintenance" technology is complementary. It not only enhances the value of existing tool-chain, it is much needed for mission critical and infrastructure operations without internet and electricity.

References

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