Blockchain & Edge IoT for Economy of Scale in Wind Industry


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Background and Aims

• Understand the relevant perspectives, and challenges for wind turbine supply chain operations.

• Identify and map components/processes with potential benefits from Blockchain technology.

• Focus on bolts and fasteners life-cycle oriented digital traceability, cross-organizational data sharing, and quality assurance/validation.

→ Development of a demo Blockchain, QR/Bar codes, IoT, Node-Red, and Edge computing to give tangible evidence.
Challenges

- Complex Buyer-Supplier relationship
- Heterogeneity among wind industry components
- Lack of digital traceability

Specifically:
- Flow of trusted, transparent, and quality information among value-chain stakeholders.
- Registration of each event in the commodity components lifecycle.
- Contribute to the sustainability of manufacturing and maintenance operations.
Solution - Architecture

Blockchain Network
(Trusted, Immutable, Transparent Traceable & Distributed)

Traditional Organisational specific digital services

5G/LTE/TCP-IP Internet

IoT Edge Device
(Wind turbine/bolt fasten control)

Manufacturer
Vendor
Service Staff

Operations

Measurements/ Operations/Quality Data

BLE/IP/ Lora/Radio etc.
Prototype

Register Id
- QR Codes for Turbine and Bolt Identification
- Ethereum based Application APIs provides QR code generation

Digital Tagging
- Tag Turbine and Bolt with QR codes
- Physical asset mapping to digital traceability in Blockchain

Device Register
- Turbine, Batch of Bolts (using QR Code)
- Scanner & Digital Wrench Device

Action Mapping
- Perform bolt fasten operation using digital wrench on bolt.
- Real time Torque measurements monitoring started.

Tracing
- Data/Metadata is collected and processed in IoT application.
- Application sends data to blockchain network accessible to all stakeholders in transparent, secure and trustable manner.
Benefits

- Digital identification of physical assets in the chain and semantic mapping to the relevant events.
- IoT-enabled real-time data-driven and error-prone operations.
- During the maintenance phase, any anomalies in components such as broken bolts can be identified, traced back to suppliers, and correlated for proactive actions.
- Blockchain is providing the capability of:
  - digital traceability of wind turbine events in its life cycle.
  - transparent data sharing in a trustable manner among different stakeholders
  - improvement in quality assurance/validation during operations
  - guaranteed immutability of information.
  - event associated decisive ownership in a multistakeholder environment.
Conclusions

- Blockchain (along with digital technologies such as IoT) is found to be value-adding in the wind industry supply chain by:
  
  • Bringing digital traceability, cross-organizational/stakeholder data sharing, and relevant quality assurance/validation of events.
  
  • Building a transparent, trustable, immutable, and decisive ownership environment.
  
  • Providing economy of scale over operations execution on commodity products and related supply chains in the wind industry.
Thank you