AI@work – How AI is transforming Industry

Creating the Metaverse of the Industrial World

March 2022
Confidential
Industries globally waste $650 billion in unplanned downtime\textsuperscript{1}

Industries contribute to 20\% of the global carbon footprint\textsuperscript{2}

\textbf{Leveraging AI and Big Data to drive sustainability}

- Asset Health & Predictive Maintenance
- Energy Efficiency
- Process Efficiency
- Resource Efficiency
- Workforce Safety & Security

\textbf{Incorporating sustainability across the industrial value chain}

\textbf{Solving the Sustainability challenge with AI & IoT}

Sustainable manufacturing – creating a world of manufacturing with no waste

1. International Society of Automation 2. World Economic Forum
Applicable across sectors
Wide domain expertise across industries

Renewables  Transportation  Ports & Shipping  Oil & Gas  Manufacturing

FMCG  Aviation  Steel  Automotive  Real Estate
AI can be applied to solve industrial challenges

**AI Product suite**

- **Predict.AI** - Asset Health & machine performance – wind turbines & solar farms
- **Track.AI** - Supply Chain Optimization and performance monitoring – Train, Trucks, Container
- **Conserve.AI** - Smart Buildings – Healthy Buildings - Increasing the value of buildings
- **Smart Factory** – Reliability & Predictive maintenance
- **Port.AI** - Smart Port – cranes to containers
- **Spot.AI** - Asset Tracking, Inventory Management, & Workforce management – Factories, Warehouse, Buildings
- **Conserve.AI** - Energy Efficiency & Sustainability - Factories & Buildings
- **Trust.AI** - Visual Analytics – Quality, defect detection, Safety, Security
Technology

Full-stack Orion platform for real-time connectivity, intelligence, and automation.

Connectivity

Connect people, things & Processes (IoT) – Collect the Data – Data Engineering & Contextualisation

Deep Learning/AI

Real Time Intelligence (AI) – Develop AI Models - Analyze

Automation

Automate processes – Deploy AI Models - Act
End to end solutions..IoT to insights
Product + Service capabilities. “Orion” – operating platform for IoT and AI

BLP Industry.AI

IOT devices

Partner Ecosystem

BLP Industry.AI audits, does the engineering & architecture design, and installs 3rd party IoT devices in factories/buildings/assets.

IoT devices

Data Ingestion

Communication

Device Control

Industry.AI Edge Software & IoT Gateways

Proprietary Edge software connects all IoT protocols. BLP works with a number of 3rd party gateway suppliers.

Industry.AI Cloud Platform: Orion

"Orion" – BLP Industry.AI’s proprietary industrial digital platform for IoT and AI. Cloud agnostic – Google, AWS, Azure

AI/ML Algorithms

Integration

Actionable Insights

Enterprise scale AI software products customized for a number of industries.

Enterprise scale software applications

Asset Management

Inventory Management

Supply Chain - Fleet Management

Smart Buildings

Smart Ports

Partner Ecosystem
# The Metaverse of the Industrial World

Creating the metaverse of the industrial world to transform industry & manufacturing

## Activities

<table>
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<th>Digital World</th>
<th>Artificial Intelligence</th>
<th>Virtual Reality</th>
<th>Digital Twin</th>
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<td>Quality</td>
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<td>Safety</td>
<td>Near misses</td>
<td>Work environment</td>
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## Physical World

- Digital Sensors
- Internet of Things (IoT)
- Robots

## Infrastructure

- Gateways
- User Interfaces
- Cloud
- Hosting & Bandwidth
- Compute power
What makes us different?

People + Culture. Data Security & Privacy. Product + Service company - SaaS, PaaS, AI@service
Global Partnerships – Google Cloud, Apple, PWC, etc.

End To End Solutions
Installation of hardware/IoT – Data Aggregation – AI Analytics - Insights

AI Insights – 80+ algorithms
80+ proprietary algorithms developed in-house focused on industrial productivity

Innovation Culture
R&D lab + RoC in Bengaluru + High Frequency Data + 5G

Frugal Manufacturing
Orion IoT/AI platform aligned with frugal manufacturing to drive Quality and Reliability

Industrial eco-system – Open Architecture
Platform to bring all stakeholders together – OEMs, Telco, Cloud, Customers, IoT manufacturers etc.
Application - Core AI – Orion Platform - Industrial Digital Platform - Providing industrial intelligence to improve productivity and quality
AI/ML Techniques in Action

Following are typical algorithms being used for developing various solutions:

**Tree Based / Ensemble**
- CART
- ID3
- Random Forest
- Bagging
- Boosting
- AdaBoost
- C4.5 / C5.0
- CHAID
- Decision Stump / M5
- Weighted Average (Blending)
- Stacking
- GBM
- GBRT

**Classification**
- AODE
- BBN
- BN
- LARS
- Naive Bayes
- Gaussian Naive Bayes
- Multinomial Naive Bayes

**Regression**
- Logistic Regression
- Linear Regression
- Ridge Regression
- LASSO
- Elastic Net
- LARS

**Neural Nets**
- LSTM
- MLP
- Back Propagation
- Hopfield Network
- RBFN
- Stochastic Gradient Descent

**Clustering**
- k-means
- kNN
- EM
- LVQ
- SOM
- Ranking SVM
- one class SVM
- Hierarchical Clustering
- Locally Weighted Learning
- Affinity propagation

**Time-Series**
- ARMA
- ARIMA
- SARIMA
- SARIMAX
- Holt Winters

**ARM**
- Collaborative-Filtering (CF)
- Apriori Algorithm
- ECLAT
AI/ML Capabilities

Over 80 algorithms developed over 6 years for more than 20 Industrial segments

**Industries**
- Wind Energy
- Solar Energy
- Oil & Gas
- Chemicals
- Tire
- Glass
- Steel
- Aluminum
- Cement
- Refractories
- Thermal Power Plants
- Automotive Spare Parts
- Aviation
- Supply Chain Management
- Transportation (Rail/Road)
- Shipping
- Ports
- Electrical Goods & Appliances
- FMCG
- Sugar
- Ceramic Tile
- Commercial Buildings

**AI/ML Capabilities**

- **Failure Prediction**
  Predicting failures in advance with the help of advanced AI model trained & tested on historical data and validated on live data

- **Anomaly Detection**
  Identification of deviations far away from the normal behavior and suggesting the impact and risk exposure

- **Recommendations**
  A prescriptive approach to suggest actionable insights for implementation on the field by frontline resources

- **Dynamic Threshold**
  A tailored approach to address highly sensitive specialized issues based on the current level of operations given the historical exposure and behavior

- **Asset Health Prediction & Diagnostic**
  Learning from the past events and historical behavior and predicting the reliability of the equipment / entire process

- **Energy Analytics**
  Applying deep knowledge of domain and data science to address challenging issues causing high specific energy consumption
## Industry.AI algorithms & applications

<table>
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<tr>
<th>Heat Map Scale</th>
<th>Wind</th>
<th>Solar</th>
<th>Oil &amp; Gas</th>
<th>Chemicals</th>
<th>Tire</th>
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<th>SCM</th>
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Application – Predict AI – Smart Factory
Plant Digitalization. APM. OEE
How does it work?

The Industry.AI IoT team installs the IoT devices and connects them through BLP Edge. The platform is compatible with all protocols and therefore helps scale and deploy IoT applications seamlessly.
Architecture
An integrated solution – from data input to insights. Detect, Improve, Automate

Data Sources
- Maintenance Data/Failure Data
- Enterprise systems
- Zone and Territory level Sales Data
- Store Info and Credit History
- Sensors/SCADA/PLC – Vibration, Temperature, Flow etc
- Weather data
- Camera/CCTV

ORION PLATFORM

BLP edge data collector

AI/ML/DL

Data Processing

Infra Services

Analytics

Visualization – Mobile/web

Control / Alerts

Applications
1. Sales forecast & Planning
2. Predictive Maintenance
3. Asset Performance

Platform As a Service
Unit-1: Site Visuals

1. Line-02 Rough Press Machine

Data Frequency: 5 Seconds
Unit-1: Site Visuals
Main Motor vibration and temperature monitoring

Vibration Sensors for collecting data from Non-Driving and Driving End Of the Motor.

Temperature Sensors for collecting data from Non-Driving and Driving End Of the Motor.
Unit-1: Site Visuals
Friction Wheel bearing vibration and temperature monitoring

Vibration Sensor for collecting data from descent/ascent friction side of the bearing wheel.

Temperature Sensor for collecting data from descent/ascent friction side of the bearing wheel.
Unit-1: Site Visuals

Friction Wheel/Break Pad Gap monitoring during forging & Idle time

Gap Measurement using Laser sensor on ascent side of the Flywheel.
Application - Conserve.AI - Smart Buildings - Energy Efficiency - Sustainability
Connected Buildings

IoT is driving efficiency and sustainability

# of Connected devices - Buildings

By 2020: >30% connected devices in every building
End to End digitization solving modern problems

**Standardization**
Standardization, reusability, and mobile technology mean less effort in engineering and deployment

**Energy Efficiency**
Buildings have the highest untapped energy efficiency potential by sector

**Connected IOT**
Predictive maintenance enabled by IoT and artificial intelligence

**Customer Experience**
A more personalized, comfortable experience drives productivity

- **30%** Possible Reduction in engineering
- **82%** Untapped Potential in Energy Efficiency
- **20%** Energy Savings Per Year
- **11%** Increase in customer experience

30% Possible Reduction in engineering

82% Untapped Potential in Energy Efficiency

20% Energy Savings Per Year

11% Increase in customer experience
## Digitization drives Sustainability

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Measure</strong></td>
<td>Need connectivity of all key equipment regardless of manufacturer. Install additional IoT devices if required</td>
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<tr>
<td><strong>Transparency</strong></td>
<td>Provides insights into the building and factory operations</td>
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<tr>
<td><strong>Traceability</strong></td>
<td>Identify areas for savings</td>
</tr>
<tr>
<td><strong>Connect people to the building</strong></td>
<td>Mobile and connectivity provides greater cohesion</td>
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</tbody>
</table>
Conserve.AI - Integrating all operational parameters of a building onto one platform – energy, water, waste, fire, security, DG, air quality, etc.

Using AI and IoT to improve operational efficiency and transparency.
Conserve.AI - Integrating all operational parameters of a factory onto one platform – Process heating, motors, compressor, boiler, energy, water, waste, DG, etc.

Using AI and IoT to improve operational efficiency and transparency
Conserve.AI - Integrating all operational parameters of a factory onto one platform – Process heating, motors, compressor, boiler, energy, water, waste, DG, etc

Using AI and IoT to improve operational efficiency and transparency

Orion Platform & Applications

industry.AI

Air Quality
Application – Trust AI – Video Analytics for real time event detection –– Safety, Security and Quality
Visual Analytics Platform
Delivering High Return on Investment

Hospitals, Hotels & Schools
Retail Stores
Commercial Buildings
Transportation/Supply Chain
Manufacturing/Warehouses

Existing Camera Feed Stored in Local Servers

Orion Platform
In-House Algorithms

Advanced Analytics

Predicative Analytics + Real Time Data

Orion Cloud Platform

Delivering High Return on Investment
AI Application - Visualization
Transforming video feed into actionable insights

IN-DEPTH MONITORING
Ability to monitor each individual camera
Data Metrics and Parameters

**Occupancy**
Count People and Vehicles Entering and Exiting

**Age, Gender, Emotions**
People Demographics

**Intrusion**
Reliably detect intrusion into your facilities

**Dwell /Loitering**
Time people spend in specific zones

**Queue Management**
How long are employees/ customers waiting in line?

**Smoke/Fire Detection**
Visually detect fire and smoke in camera views.

**Security**
Object and people detection models to ensure safety

**Heat Maps**
Visual representation of Zone Data

**Throughput**
Detect objects crossing specified edges of the zone

**Walk By**
Managing walk in's

**Alerts**
Maintenance & Security Alerts

**Parking Management**
Vehicle Analysis
Safety – Track usage of PPE and compliance of safety norms
Safety - Social distancing using computer vision models

Breach Count: 2
Alert!!
Safety – Mask Detection using computer vision models
Use Cases – Trust.AI...the future

**Automation** - video feed ingestion, enrichment & structuring

**Quality** – Track manufacturing defects on a production line correctly.

**Safety** - Visual inspection for PPE compliance in factories & ports. Monitor worker behavior in construction sites

**Security** - Real Time vehicular traffic monitoring

**Visual auditing** - Ensuring compliance of trucks, trains or windmills out in the field

**Retail** - Use a travel image to find retail suggestions in that area etc.
Safety - Railways – identification of defects with Visual analytics
Safety – Geo Fencing
Manufacturing Defects – Quality Improvements

Improve quality control by detecting defects using real time video processing.
Safety – Construction Industry

Ability to scan large construction sites
Safety – Fire/Smoke
Substations
Security – Warehouses
Real time alerts using Visual Analytics
Application – Improving machine performance and uptime - Wind and Solar Farms
Transforming Operations & Maintenance

Creating the Digital power plant, reducing maintenance expenses

**Digital Strategic KPI**
- Plant Digitization
- IoT
- Big Data Analytics/AI
- Operations & Maintenance driven by Deep Learning

**Objectives and Benefits**
- Predictive Maintenance
- Optimisation of Maintenance
- Operational efficiency
- Optimisation of maintenance costs
- Maximisation of energy availability
- Optimisation of energy production
- Improvement of Safety

**Benefits**
- IoT/Infrastructure
- Data Standardization
- Data Reliability
- End to end Digitization
- Increased Performance

Using Automation and sensors to extract live and historical data

Network of devices connected, remote operations with IoT cloud

Big Data Analytics & AI
Data Analytics, predictive maintenance, AI, machine learning and cognitive computing

End of page
Comprehensive AI and ML Algo’s

The Orion Platform includes a suite of inhouse algorithms and analytics to increase competitive advantage and increase revenue.

**Wind**
- Early Fault Detection
- Yaw Mis-alignment
- Icing
- Blade Pitch Angle
- Blade Corrosion
- Useful Remaining life
- Power Curve Deviation
- Critical Component Monitoring
- Overall Health Assessment

**Solar**
- Soiling Loss
- Performance Monitoring
- Under-Performance Studies
- Faulty Pyranometer Detection
- Inverter Efficiency
- Root Cause Analysis
- Losses Computation
- MFM Monitoring
- Module Temp Prediction
Visor Installation
Ability to capture data from 300 wind turbines
Sensor Installation

Ability to install sensors in all the rotating parts like Generators, Gearbox, Motors, and Bearings. The Image below shows the installation of sensors to detect electrical output in the rotor.
Results ... Case Study

Early detection of Anomaly on Negative sequence voltage resulted in prevention of generation losses and a potential major failure

- Found Anomaly on TGP-37 first intimation given on 30th March
- Found Anomaly on TGP-37 Second intimation given on 30th April
- Got feedback from customer that Site team replaced the earthing carbon brush.
- Found critical Anomaly on TGP-37 third intimation given on 16th July
- Found the same anomaly continuing on the same Turbine and fourth intimation given on 4th August
- 24th August – 12% above the fault limit
- Corrective action taken by customer and after 3rd Sep the turbines look normal and both running fine

- Negative Sequence Voltage More than 5% on 20-April-2020
- Negative Sequence Voltage More than 12% on 24th-Aug-2020

Early detection of Anomaly on Negative sequence voltage resulted in prevention of generation losses and a potential major failure.
Summary

✓ End to end solution. Digitize Operations through IoT solutions. Dedicated IoT team to install the devices and ensure connectivity

✓ Orion - Industrial digital ecosystem bringing together machine OEM’s, telco, cloud, customers and IoT providers

✓ Integrated approach - Identify & capture data, analyse & visualize the data, and provide actionable insights through AI based applications

✓ Increase productivity through big data analytics....improve returns, and drive sustainability

✓ Improve competitiveness through digital transformation
Thank You

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Video: https://www.youtube.com/watch?v=ZdSYaWYo0pM
https://industry-ai.com/covid-19/
Website: www.blp.co.in; https://industry-ai.com/