A&D - Interview
Suresh D, CEO,
Spark Minda Technical Center,
Minda Corporation and Group
CTO, Spark Minda Group

COBOTS & I4.0
TOOLS FOR MSMEs & LARGE ENTERPRISES FOR DIGITAL TRANSFORMATIONS

A&D - Interview
Suresh D, CEO,
Spark Minda Technical Center,
Minda Corporation and Group
CTO, Spark Minda Group
Companies

Power & Energy  P. 32
Test & Measurement  P. 35
Fieldbus & Networking  P. 38

When the chips are down... Coping with the semiconductor shortage  P. 28
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- Drives & Components
- Field Buses & Networks
- Image Processing & Measuring Technology
- Software & Engineering Tools
- Robotics & Handling
- Control & Regulation Technology
- Sensors & Encoders
- Industrial Computers & Peripherals
- Electrical Engineering & Energy Technology
- Gear-Motors & Mechanical Speed transmission

Select the one title that is most appropriate for your position. (select only one)
- 01. Corporate / General Management
- 02. Director, Supervisor
- 03. Group Leader, Project Leader
- 04. Manager, Specialist
- 05. Engineer, Technocrat
- 06. Other

Select the one title that describes your principle job function. (select only one)
- 01. Management
- 02. IT
- 03. Safety & Security
- 04. Risk Management, Accident Management
- 05. R&D
- 06. Design Engineering (Plant Engineering)
- 07. Project Planning, Production Planning
- 08. Laboratory, Test, Field Service
- 09. Explosion Protection, Fire Prevention
- 10. Manufacturing, Production
- 11. Quality Assurance
- 12. Reliability, Evaluation, Services
- 13. Energy & Environment Technology
- 14. Facility Management
- 15. Sales, Marketing
- 16. Purchasing
- 17. Warehouse, Transportation, Logistics
- 18. Consulting / Advisory
- 19. Education
- 20. Other

Select the one industry which best describes your company's primary business activity (select only one)
- 01. Industrial Machinery
- 02. Electrical & Electronics equipment
- 03. Communication & Information Technology
- 04. Power & Energy
- 05. Automotive Manufacturing
- 06. Steel / Metal
- 07. Optics & Precision Mechanics
- 08. Chemical & Pharmaceutical Industry
- 09. Bio & Environmental Technology
- 10. Mining, Oil, Gas
- 12. Food & Beverage
- 13. Textile, Leather
- 14. Building Automation
- 15. Technical Consulting, Engg. related services
- 16. Machine Tools
- 17. Plastics & Polymers
- 18. Construction
- 19. University, Education
- 20. Other

What is the approximate number of employees in your company? (select only one)
- 1 to 9
- 10 to 19
- 20 to 49
- 50 to 99
- 100 to 199
- 200 to 499
- 500 to 999
- 1,000 to 2,999
- 3,000 & more

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The drivers of an inclusive transition

The World SME Day on 27 June is celebrated all over the world to recognise, applaud and create awareness of contribution of SMEs to the economy. It’s a known fact that SMEs are a crucial factor in any country’s competitiveness, wealth creation, quality of life and employment. Contributing 45% to the industrial output, 35% to the direct exports, 8% to the GDP, India’s SME sector provides employment to 60 million people through 28.5 million enterprises and is the key driver in the nation’s economic growth. In spite of the limitations like low capital base and inadequate exposure to international environment, the SMEs in the last few years have made significant contribution towards the industrial growth, technological development and exports. However, the pandemic changed the whole picture, leaving a major impact on SMEs.

The need of the hour is to ensure that SMEs are resilient to the crisis, emerge stronger from the aftermath of the crisis, and become the drivers of an inclusive transition towards more sustainable economies. Advanced automation technologies and digital transformation are currently the most recommended solutions for revival and sustainability in SMEs.

While automation & digitalisation promise improvements in efficiency and management agility, it also brings in its own challenges, as far as its realisation by SMEs is concerned. The very first is the affordability, then comes the awareness and of course the application knowledge. In this context, on the occasion of the World SME Day, we are happy to bring you the Cover Story in this edition, that talks on cobots & Industry 4.0 technologies - the digital transformation tools for SMEs - and features smart manufacturing stories of implementation of cobots in SMEs through case studies. You will also find articles and experts’ views on many more such topics in this edition that will take you closer to the technology world. Happy reading!

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CONTENTS

MARKET

08 NEWS

12 “Start ‘designing in India’ & not just ‘making in India’”
  Interview with Priyesh Mehta,
  Director, Imaginarium (Rapid)

START-UP

13 “Harnessing the power of human intelligence”
  Interview with Sekar Udayamurthy,
  Co-founder and CEO, Jidoka Tech

OPINION

14 RaaS – a need to have
  The opinion feature discusses why Robotics-as-a-Service (RaaS) is attractive and why the RaaS model is extremely important right now

TRENDS

22 Accelerating supply chain profitability and sustainability
  The article discusses the four key trends that will shape supply chains going forward

TECHNOLOGY

COVER STORY

16 Cobots & 4.0: Tools for MSMEs & large enterprises for digital transformations
  The Cover Story gives a blueprint of the cobots technology and smart manufacturing stories of implementation of cobots in SMEs through case studies

VIEWPOINT

28 When the chips are down...
  Coping with the semiconductor shortage
  The Viewpoint reveals the triggers that led to the shortage of semiconductor chips and its impact on Indian automotive manufacturers

MANAGEMENT

INTERVIEW

26 “It is important to watch the dynamic response & trends of the industry”
  Suresh D, CEO,
  Spark Minda Technical Center, Minda Corporation and Group CTO, Spark Minda Group Companies

32 POWER & ENERGY
  This article discusses how automation has become an integral part of the energy industry

44 CHEMICAL & PROCESS
  The article studies the breakthroughs various digital technologies can bring in the chemicals sector
16

COVER STORY
The Cover Story gives a blueprint of the cobots technology and smart manufacturing stories of implementation of cobots in SMEs through case studies

FOCUS
THE DISTRIBUTION OF ENERGY & THE ROLE OF AUTOMATION

35
TEST & MEASUREMENT
The case study explains how IVS combined AI machine vision with cutting-edge robot automation

FOCUS
POWER & ENERGY
32 The distribution of energy & the role of automation
This article discusses how automation has become an integral part of the energy industry

TECHNOLOGY
TEST & MEASUREMENT
35 Future-proofing collaboration: Combining robots and machine vision
The case study explains how IVS combined AI machine vision with cutting-edge robot automation

FIELDUSES & NETWORKS
38 Fieldbus and networking application in the manufacturing industry
The article elaborates on the different facets of fieldbus technology

DIGITALISATION
41 Realising the immediate and future benefits of digital transformation
The article explores how manufacturers can properly leverage IIoT and connect islands of automation

CHEMICAL & PROCESS
44 Disruptive digital technologies in the chemical industry
The article studies the breakthroughs various digital technologies can bring in the chemical sector

New Products
47 High-end PC for mobile machinery; Single-pair Ethernet cables; Industrial gear units; HMI operator workstation
48 Intelligent edge automation platform
49 Industrial shock absorbers

Columns
03 Editorial
04 Contents
06 Guest Editorial
50 Highlights – Next issue
50 Company Index
In the last one year, COVID-19 has not left any sector untouched. With disruptions due to lockdowns, social distancing norms and safety measures to protect customers & employees, industrial companies have undergone a significant transformation, especially within enterprise management, as digital technologies have led to new customer experiences as well as new sales & marketing services. Moreover, the pandemic has exposed the fragility of many sectors, driving companies worldwide towards witnessing the next big revolution in industrial history, the one brought on by ‘Intelligent Industry’. Companies are now, more than ever, driven to use data, embedded software, Artificial Intelligence, new generation wireless connectivity and other digital processes to rethink the products and processes that they offer to clients while reimagining their operations and inventing new services and business models.

Intelligent Industry goes beyond what we currently know as ‘Industry 4.0’. It is the next level of digital transformation – the one which is powered by data. Although today’s product might look as if not much has changed, there have been huge changes in terms of what is going on inside them. They are internally driven by digital technology more than ever before. These smart products churn out almost unimaginable amounts of data, opening avenues for companies to find insights to improve operational performance, reliability and autonomy, bring innovations, drive lower costs and deliver intelligent products to the market faster.

Today, every industry’s structure is faced with the challenge of harnessing data at scale, which calls for creating a manufacturing model with self-learning at its core and using data gathered as the foundation of new value chains. The use cases of Intelligent Industry are limitless and span across industries world over. In Spain, a collaboration with four leading industry players in the fight against COVID-19 has led to the development of AI models in chest x-rays, which allows healthcare professionals to leverage advanced diagnostic tools from any location through advanced connectivity like 5G while assuring patient data privacy. Using industrial IoT solutions, an oil and gas major transformed its shop floor processes and manufacturing execution systems in Italy to achieve productivity gains and prevent 26,000 hours of valuable machine downtime across all its plants in just five months. Smart engineering solutions leveraging AR, VR and mixed reality for validation of train systems have led to developing an award-winning virtual train solution in France.

Leveraging the extensive capabilities of the Intelligent Industry, mobility will be made smarter and safer by autonomous vehicles, while research and customer insights will reach manufacturers quicker, enabling them to launch personalised products, resulting in less waste. In addition, edge computing will make it possible to run applications close to the source of action. Combining 5G and edge, Intelligent Industry promises to bring business and customers even closer, and this ‘zero distance’ makes way for new experiences for consumers on how they move, shop, communicate, consume content and ensure healthy living.
### Motors

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Series</th>
<th>82840</th>
<th>82860</th>
<th>82800</th>
<th>82880</th>
<th>82900</th>
<th>80440</th>
<th>80350</th>
<th>82510</th>
<th>82330</th>
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<tbody>
<tr>
<td>Nominal power (W)</td>
<td></td>
<td>0.9 / 3</td>
<td>9 / 33</td>
<td>27 / 95</td>
<td>15 / 35</td>
<td>54 / 104</td>
<td>66 / 150</td>
<td>310 / 600</td>
<td>0.3 / 3</td>
<td>0.2 / 0.4</td>
<td>0.5 / 5</td>
</tr>
<tr>
<td>Front side (mm)</td>
<td>Ø 32</td>
<td>Ø 42</td>
<td>Ø 63</td>
<td>Ø 42</td>
<td>Ø 63</td>
<td>50 / 57</td>
<td>50 / 57</td>
<td>0.75 / 0.8</td>
<td>0.75 / 0.8</td>
<td>0.75 / 0.8</td>
<td></td>
</tr>
<tr>
<td>Nominal speed (rpm)</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
<td>250 / 600</td>
<td>600 / 720</td>
<td>0 / 1500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal torque (mN.m)</td>
<td>2.1 / 77</td>
<td>41 / 100</td>
<td>170 / 270</td>
<td>50 / 110</td>
<td>190 / 290</td>
<td>65 / 50</td>
<td>390 / 1900</td>
<td>10 / 10</td>
<td>25 / 8</td>
<td>15 / 300</td>
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<tr>
<td>Noise level (dBA)</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>35</td>
<td>45</td>
<td>40</td>
<td>50</td>
<td>30</td>
<td>45</td>
<td>35</td>
<td></td>
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<tr>
<td>Service life (hrs)</td>
<td>2000</td>
<td>3000</td>
<td>5000</td>
<td>4000</td>
<td>5000</td>
<td>20000</td>
<td>20000</td>
<td>20000</td>
<td>10 M on / off</td>
<td>20000</td>
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### Control Electronics

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<tr>
<th>Characteristics</th>
<th>Series</th>
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<th>SM121</th>
<th>SM122</th>
<th>BDE 30</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage</td>
<td></td>
<td>10 → 36 VAC</td>
<td>9 → 75 VAC</td>
<td>9 → 75 VAC</td>
<td>18 → 36 VAC</td>
<td>10 → 36 VAC</td>
</tr>
<tr>
<td>Service life (hrs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Gearboxes

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Series</th>
<th>11 models</th>
<th>7 models</th>
<th>2 models</th>
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<tbody>
<tr>
<td>Torque (N.m)</td>
<td></td>
<td>0.5 / 6</td>
<td>0.8 / 12</td>
<td>10 / 20</td>
</tr>
<tr>
<td>Power (W)</td>
<td></td>
<td>0.2 / 50</td>
<td>8 / 600</td>
<td>25 / 600</td>
</tr>
<tr>
<td>Service life (hrs)</td>
<td></td>
<td>10 / 10</td>
<td>50 / 50</td>
<td>50 / 50</td>
</tr>
</tbody>
</table>

### Accessories & Options

- Brakes from 0.25 to 4.5 N.m
- Encoders from 1 to 1000 Pulses per Revolution
- Special connectors
- Special output shafts (design and/or material)
- Others: on demand

### Adapted Products

To meet your expectations, Crouzet offers you custom products matching your requirements, in the following areas:
- Control electronics
- Motor characteristics
- Gearboxes
- ...
CII President pegged India’s GDP growth rate for 2021-22 at 9.5%

CII recently outlined its agenda for the year under the theme of ‘Building India for a New World: Competitiveness, Growth, Sustainability, Technology’. Pegging India’s GDP growth rate for 2021-22 at 9.5%, T V Narendran, President, CII and CEO & MD, Tata Steel, noted, “Ultra-high frequency indicators strongly presage growth recovery following the second wave of the pandemic. With the recent uptick in mobility indicators, traffic congestion index and daily railway passenger movement, we believe that 9.5% growth rate can be achieved this year.”

Mentioning that growth needs to pick up to 9% by 2024-25 with public expenditure, reforms and vaccination as key levers, the President stated, “The cumulative impact of the two waves on incomes and consumer sentiment, coupled with the increase in household medical expenses in the second wave, is likely to affect consumer demand for some time. Therefore, as the economy reopens post the second wave, a dual-pronged Government strategy is required to boost consumption and support the industry till the demand is well-entrenched.”

He batted for a strong fiscal stimulus and Government expenditure programme. CII suggested a multi-pronged National Oxygen Development Plan to create a robust oxygen ecosystem and a range of measures for accelerating the vaccination. It stated that the Government should fast track all necessary licensing requirements and pay in advance for purchases besides providing capital subsidies to incentivise production. It should urge the IP owners of vaccines to issue licenses for mass manufacturing with the transfer of technology.

“With a majority of the population vaccinated by the end of this year, implementation of big-ticket reforms in factor markets and the financial sector and a large fiscal stimulus, we will be able to reach the critical $5 trillion mark by 2025-26. This is the best-case scenario that CII has estimated,” stated Narendran and added, “CII has set up several task forces to go into the issues of the third wave of pandemic preparation, risk surveillance and early warning systems and strengthening scientific data.”
Kirloskar Brothers build a dedicated technology unit for nuclear applications segment

Kirloskar Brothers Limited (KBL) recently built a new manufacturing division at the company’s mother plant in Kirloskarvadi, Maharashtra, called Advanced Technology Product Division (ATPD). As the name suggests, the ATPD has primarily been built as a dedicated manufacturing division for high-end technology products, especially those used for nuclear applications. It is a state-of-the-art facility spread across a 6000 sq mt area and is fully equipped with modern machines and test facilities, including special measuring instruments. The facility is a one-stop-shop for machining, quality control checks, assembly and testing under high pressure & high temperature. Commenting on the development, Sanjay C Kirloskar, Chairman & MD, KBL, remarked, “Our R&D team is constantly working to increase the efficiency of our products to deliver the best customer experience. Keeping this in mind, we decided to build a dedicated unit for the upgradation of our existing products as well as the development of futuristic and technologically advanced solutions for the nuclear application segment.”

Tata Technologies and Logility partner to provide digital transformation solutions for the global supply chain

Tata Technologies recently collaborate with Logility to offer digital supply chain transformation solutions to its customers across automotive, industrial heavy machinery, aerospace, industrial and medical devices verticals to help them achieve agility and improved resilience in the new normal. Speaking on the occasion, Warren Harris, MD & CEO, Tata Technologies, said, “Tata Technologies, with a vision of ‘engineering a better world’, enables the manufacturing industry to design, build, manage and realise better products. Through this global collaboration, we aim to further accelerate our customer’s digital transformation journey by offering targeted digital supply chain solutions that leverage our intimate understanding of the manufacturing industry and Logility’s solution portfolio.” Further, Keith Charron, COO, Logility, remarked, “Our collaboration with Tata Technologies will help businesses accelerate their digital transformation goals to achieve agility and resilience in their supply chains. We are excited to work with Tata Technologies and leverage their deep domain knowledge of the manufacturing industry to expand our global presence and help manufacturers address their supply chain challenges.”

Samarth Udyog Mission, IIT Delhi and AIA set up IITD-AIA Foundation for Smart Manufacturing

Samarth Udyog Mission of Department of Heavy Industry (DHI), Govt of India, IIT Delhi and Automation Industry Association (AIA), together with industry sponsors, has set up IITD-AIA Foundation for Smart Manufacturing (FSM) that helps, supports and develops smart manufacturing concepts for the Indian industry to witness, ideate and try out in their plants. The collaboration is also aimed at developing a holistic educational curriculum and skill-building programme through a vibrant incubation and administrative environment. FSM skills is a holistic platform for providing immersive training experience through live lectures, online learning, live demonstrations, live labs and self-paced exercises on remotely accessible actual hardware. Under the Azadi ka Amrit Mahotsav programme, the foundation recently launched online summer internships for expanding talent & capabilities for smart manufacturing.

Explaining the importance of self-reliance in manufacturing, in context with Aatmanirbhar Bharat, at the orientation for the internship, Anup Wadhwa, Director, AIA, described, “India is still an emerging country in terms of development. One of the most important parameters for a developed country is its ability to make quality, precision products and compete at the global level. One of the ways to make the Indian manufacturing industry competitive is to make smart machines.” He added that the learners of this programme are to be focused so that they can be recommended to the prospective machine builders and manufacturing companies for actual real-time deployment on their shop floors.

Taking the talks further, Dr Sunil Jha, Professor – Dept of Mechanical Engineering, IIT Delhi, explained that the lab is developed in association with industry partners, who are working closely and supporting all the initiatives of FSM, along with all the specialisations available at IIT Delhi, which will facilitate the development of smart manufacturing technology with support from DHI. He went on and said, “All the machines in the facility are created by the FSM team, i.e. they are engineered and programmed in that lab itself. A real-time assembly line is created so that attendees can have hands on with various parts of the shop floor, like multiprocess robotic cell, digital twin for training, multimaterial 3D Printing, robotic welding cell, etc.”
International Federation of Robotics releases ‘World Robotics R&D Programs’

International Federation of Robotics recently researched on the targets of the officially driven government programmes and published the update paper of ‘World Robotics R&D Program’. Talking about the World Robotics R&D Programs, Prof Dr Jong-OH Park, Vice-Chairman, IFR Research Committee and member of the Executive Board, asserted, “The first version of World Robotics R&D Programs was introduced in June 2020. Since then, dozens of countries have updated their robotics R&D programs. The five most advanced robotics countries, South Korea, Japan, Germany, USA and China follow a very different strategic focus.” The strategic plan Made in China 2025 comes as a blueprint to upgrade the manufacturing capabilities of the Chinese industries. In order to promote the rapid development of intelligent robot technology, the key special projects of ‘Intelligent Robots’ are being deployed in accordance with the requirements of the innovation chain. China wants to cultivate at least three leading enterprises with international competitiveness and create more than five clusters of robot-supporting industries. The statistical yearbook ‘World Robotics’ by IFR shows that China reached a robot density of 187 units per 10,000 workers in the manufacturing industry – the country ranks 15th worldwide.

In Japan, the ‘New Robot Strategy’ aims to make the country the world’s number one robot innovation hub. The rate of robotisation in the manufacturing sector targets an increase of 25% for large-scale companies and 10% for SMEs. The key performance indicator also expands the system integrators market (they are intermediate between the user and the manufacturer). The action plan includes important service sectors like agriculture, infrastructure and healthcare. According to the statistical yearbook ‘World Robotics’ by IFR, Japan is the world’s number one industrial robot manufacturer and delivered 47% of the global supply in 2019. The Intelligent Robot Development and Supply Promotion Act of Korea is pushing to develop the robot industry in Korea as a core industry in the fourth industrial revolution. The focus areas are, manufacturing businesses (with a special programme to enhance the competitiveness of SMEs manufacturing sites), selected service robot areas (including healthcare & logistics), next-generation key components and key robot software. The statistical yearbook ‘World Robotics’ showed a new record stock of about 319,000 operational industrial robots in the Republic of Korea in 2019 (+13%). Within five years, the country has doubled its number of industrial robots in operation. Following Japan and China, the country ranked third in 2019.

Under the new European Framework Program, Horizon Europe has launched research and innovation for the period of 2021 to 2027. Building on the achievements and success of Horizon 2020, Horizon Europe will support top researchers, innovators and general citizens to develop the knowledge and solutions needed to ensure a green, digital and healthy future. The robotics-related work programme is embedded in Cluster 4: digital, industry and space. Robotics-related R&D&I projects will focus on the digital transition of the manufacturing and construction sectors, autonomous solutions to support workers, enhanced cognition and human-robot collaboration.

Germany’s High-Tech Strategy 2025 is the fourth edition of the German R&D and innovation programme. The goal is for good ideas to be translated quickly into innovative products and services. Most of the framework of the High-Tech Strategy promotes partnership between companies, universities and research institutions in order to bring together institutional research and entrepreneurial expertise. It has been set the target of 3.5% of GDP per annum investment in R&D by 2025. In several programme lines of the mission ‘Shape Technology for the People’, the robotics-related programme ‘Together Through Innovation’ was launched in 2020.

The National Robotics Initiative (NRI) in the USA was launched for fundamental robotics R&D supported by the US Government. With NRI-2.0, collaborations between academic, industry, non-profit and other organisations are encouraged to better connect fundamental science, engineering, technology development, deployment and use one. A key sector is ‘Space Robotics’, where NASA launched a lunar programme named “Artemis”. The purpose of the Artemis lunar programme is to return astronauts to the lunar surface by 2024 and to construct promising capabilities for Mars missions after 2024. The Artemis lunar programme is a joint spaceflight program by NASA, the US commercial aerospace institution and international partners, including the ESA (comprising 22 countries), Canada, Japan, and Russia. The US government is planning a budget of $35 billion from 2020 to 2024. The largest investor in unmanned systems technologies remains the US Department of Defence (DOD), with a $7.3 billion budget projected in 2020 and 2021. According to the statistical yearbook ‘World Robotics’ by IFR, robot density in the manufacturing industry had been growing by 7% CAGR from 2014 to 2019 with 228 robots per 10,000 employees – ranking ninth worldwide. Regarding annual installations of industrial robots, the country takes the third position.
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- same Master
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- same Tools
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“Start ‘designing in India’ & not just ‘making in India’”

...mentions Priyesh Mehta, Director, Imaginarium (Rapid) – an organisation actively proliferating in the field of 3D Printing and manufacturing – in his interview with Anvita Pillai. Mehta discusses the company’s partnership with GE & HP, AM adoption in India, the company’s USPs and more. Excerpts...

For General Electric Additive and Imaginarium, a sharp focus on developing new applications and use cases with metal powder bed fusion technologies was a key factory and consideration. Our companies found mutual synergies in new alloy & materials development, process engineering to improve productivity and standardisation, design for AM and post-processing for AM to accelerate the industrialisation of metal AM in India.

3D Printing adoption in India contributes only 3-5% of the overall market size. At the time when major German and American shop floors were shut, Indian manufacturers were busy producing parts for the world – reiterating India’s position as a potential alternative supply chain. Government policies, like Aatmanirbhar Bharat, have certainly titillated local manufacturing sentiments, but we still are largely dependent on our Asian neighbours for raw materials and feedstock sourcing. For the success of AM in India, design talent will be key. If we start ‘designing in India’ and not just ‘making in India’, Indian products will dominate global marketplaces soon.

Our journey with HP went better than we had planned, in terms of market proliferation. The sheer brand power of HP + Imaginarium excited a lot of manufacturing companies to adopt the MultiJet Fusion technology for prototyping and production. Universities and academia were also a key adopter of this technology.

The Indian market has seen a surge in companies providing 3D Printing services via industrial printers. Any entrepreneur can invest in an industrial printing set-up by spending a couple of lakhs of rupees. What sets us apart from the competition is a key differentiator which we thrive on consultants first, then vendors. We bring an experienced team of specialists to consult clients and help them overcome challenges associated with product development and short batch manufacturing operations. We do not require MOQs for production. A client requiring one part is as precious to us as a client requiring 1000 parts.

In 2021, we plan to further push forward on our mission to make design and manufacturing accessible to everyone. The coming years will be all about co-creating new applications with our end-customers, and also taking our expertise to as many markets around the world as possible. We also wish to further strengthen our portfolio of global partners who are leaders in their own fields of technology creation, software innovation and materials development.
What we were really looking for, was a mentor who would guide us to scale rather than a person who would just fund us. We found a mentor who was also a technological entrepreneur who provided us the initial funding. It took us about three to four months to get through the legal process and getting the paperwork done, which was very new to us, and we had to learn about a lot of things quickly.

Jidoka Technologies recently obtained a seed funding of $340,000. What are the challenges that you faced for getting the funding?

We have an innovative solution that harnesses the power of human intelligence and is incorporated into the solution to automate visual inspection. This enables the last mile in the digitisation of the shop floor. We leverage AI / Deep learning to provide quality decisions on products manufactured just as a human does but with 98% accuracy, consistently and at speed. Where there is not enough data, we also do synthetic data generation. This, combined with machine vision technology, makes automation really smart.

How does Jidoka’s technology leverage AI to make automation smarter?

We are at the beginning of next continuous improvement revolution – Industry 4.0. To shape this revolution, technologies such as AI, cloud & edge solutions, 3D technologies and IoT are key. To digitise the shop floor, we would need to combine the emerging technologies mentioned earlier with proven technologies in order to make the right data available in a timely manner to all the stake holders, right from the personnel on the shop floor to the decision makers. These emerging technologies deliver the digital twin and lay the foundation for Industry 4.0. AI / Deep Learning then power the organisation by taking the data generated to the realm of predictive insights and proactive actions.

Can you share some of the emerging trends in the AI & digitisation markets today?

Data is wealth. We will need to collect a lot of data from various touch points. The first thing to do is to automate the data collection across manufacturing lines. Once we have that, one can take that data and use AI on top of it to make real-time decisions. Having acquired sufficient data, we can move into predictive insights and start looking at the next level, which is, taking proactive action and AI leveraged across all the three levels. Besides, these are things that can be done today – we don’t have to look too far. In order to take this to another level, say two to three years from now, scaling of human knowledge and expertise from the shop floor will be amplified to the organisation & beyond. This will be a bottoms-up approach while managing manufacturing KPIs and leveraging best practices on the shop floor & leveraging AI will be top-down.

With constant talks about AI in the technology world, many wonder what can be done today versus what may be years away. Can you throw some light on this?

In the long-term, we have two key targets – one is being able to provide insights to help improve business practices, reduce downtime and increase ROI. Secondly, we want to move from real-time decision making and insights into proactive actions, thereby, incrementally increasing the quality of products manufactured.

What is next in terms of technology to extend your start-up further?

“Harnessing the power of human intelligence”

... says Sekar Udayamurthy, Co-founder and CEO, Jidoka Tech – a player in the field of automated cognitive inspection – in this conversation with Juili Eklahare. He explains how the start-up makes automation smarter, the emerging trends in AI & industrial automation and what’s ahead for the company. Excerpts...
This year, with the impact of COVID-19 on worldwide businesses, more companies than ever before are gravitating towards a pay-per-use model with no substantial upfront financial commitments. The global market for contract manufacturing should grow to $2.7 trillion in 2023, which also increases the potential of robotics. One has seen start-ups move from a software licensing business to a full service business and adopting Robotics-as-a-Service (RaaS) to be more approachable to customers’ requirements. Extensive automation is unavoidable.

Typically, robots are used to replace lower-paying jobs done by humans at companies. But, since robots are quite expensive, it can take years before companies realise a return on their investment. This fact has kept many smaller organisations from capitalising on robots. That’s one of the reasons RaaS is quite attractive today due to its cost-friendly nature.

Today, robots are not just for large corporations anymore. They are making an impact in numerous sectors, but thanks to RaaS, the rewards of robotic automation can also be leveraged by small- and medium-sized companies. Today, rigid robotic solutions that are preprogrammed to complete one repetitive task no longer make sense when production needs to modify as fast as consumer tastes. Pioneering companies who endeavour to sustain the trustworthiness of their consumers will invest in flexible solutions like robotic workcells that are swiftly reconfigurable for new tasks in the warehouse or to the shifting needs of a supply chain’s workflow.

There are several examples of companies developing tools to enable RaaS on a great scale and the ways it can be used. For example, Amazon’s contribution is the AWS RoboMaker, and it includes Machine Learning, analytics services and monitoring. Or Google developing the Google Cloud Robotics Platform that combines Artificial Intelligence (AI), cloud and robotics to enable ‘an open ecosystem of automation solutions that use cloud-connected collaborative robots’.

The RaaS model is extremely important right now, as manufacturers are trying to automate key processes due to increasing wages, an unprecedented labour shortage and the rise in worldwide competition. For many manufacturers, automation is no longer a ‘nice-to-have’, but a ‘need-to-have’.

One criticism of RaaS is its practicality. Is it possible to build upon the concept of Software-as-a-Service (SaaS) with hardware? SaaS was established as the internet permitted immediate delivery, upkeep and updating of software. With hardware, there’s no instant maintenance. Can a robot manufacturer offer a similar level of service and attentiveness to its RaaS customers across the globe?

Nonetheless, the implications of RaaS are massive for the robotics industry. There are many cases in which buying automation equipment makes sense. But there are just as many circumstances, where the benefits of the RaaS model will overshadow the traditional model. As many technology providers move towards selling services such as RaaS, there are still things to overcome such as the volume of customisation of the hardware to make the robots suitable for individual organisations with precise needs. It’s obvious that the market necessitates a more flexible substitute to buying equipment, especially now, when manufacturing is facing so many challenges. Irrespective of the mounting discomforts, RaaS will be the solution many organisations hunt for.
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COBOTS & I4.0
Tools for MSMEs & large enterprises for digital transformations

India has been actively adopting digital manufacturing and its subset technologies, like cobots. Many MSMEs and large enterprises have been proved to be a successful proof of the implantation of cobots in different manufacturing applications. The present article gives a blueprint of the cobots technology and smart manufacturing stories of implementation of cobots in SMEs through case studies.

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India, as a nation, has skilled citizens with diversified expertise, availability of different and huge natural resources and abundant opportunities depending on the geographical locality, socio-economic profile and strong ease of doing business environment. The micro, small and medium enterprises (MSME) sector has emerged as a highly vibrant, dynamic sector of the Indian economy over the past five decades, and it contributes enormously to the growth of the nation’s economy. Therefore, India has a huge market potential for Industry 4.0. The essential technologies of Industry 4.0 include the Internet of Things (IoT), Virtual Reality, cyber-physical systems, Machine Learning and collaborative robots. These Industry 4.0 technologies contribute enormously to the growth of the nation’s economy.

India has seen a proven track record of implementation of Industry 4.0 in SMEs through various regional and national level initiatives by MSMEs and the Government of India. MSMEs have been spearheading the implementation of Industry 4.0 through digital MSME schemes where the existing infrastructures are converted into digital, cloud-based technologies. India has successfully launched the pilot project of Industry 4.0 by manufacturing smart digital railway coaches that host in-house cloud-based technologies, IoT and several sensors. The smart coaches are manufactured in the state-of-the-art manufacturing plant. This was implemented under the technology mission by the Ministry of Railways in collaboration with the Department of Science & Technology, Government of India, in association with the Indian Institute of Technology (IIT) Kanpur as academic partners. In addition, India has pioneered in the fourth industrial revolution through the Centre of Excellence in Industry 4.0 opened by the World Economic Forum in Maharashtra. This centre has placed India on the global map.

The concept of ‘ease of doing business’ by the Government of India has bagged the 63rd position among 190 nations in the World Bank’s Ease of Doing Business ranking. The country has pioneered innovation by scoring a 48th position in the innovation index, is on the threshold of major reforms, and is poised to become the third-largest economy in the world by 2030. MSMEs play an important role in the economic and social development of the country, thereby creating the highest employment growth as well as accounting for a major share of industrial production and exports.

The Government of India has been emerging in making India a self-reliant nation through the successful implementation of Aatmanirbhar Bharat that creates the localised products through ‘Vocal for Local’. This propels the country to make its position in the global ranking. As a result, the Indian economy is likely to emerge as one of the leading economies in the world, with an envisioned GDP of $5 trillion economy by 2024.

One of the major technologies that evolved in Industry 4.0 is the collaborative robots, aka cobots. Cobots have paramount importance in contributing majorly to Industry 4.0 and have made major breakthroughs by creating a silent, smart manufacturing environment in India.

Cobots for smart manufacturing

The challenges in the conventional manufacturing systems are precession, accuracy, connectivity of equipment and security of data. The inventory management and real-time monitoring of production and quality control has been a major challenge. Cobots come with various advanced technologies like 6-axis joint structure, 1.3kN maximum payload, 24VDC power supply, built-in heating system, KUKA control system, and configurable I/O ports. These features make cobots a reliable and efficient solution for smart manufacturing environments.

In conclusion, India has a huge market potential for Industry 4.0, and the implementation of Industry 4.0 technologies through collaborative robots is contributing significantly to the growth of the nation’s economy. India is poised to become a leading economy in the world, with a GDP of $5 trillion by 2024, and the adoption of Industry 4.0 technologies is a key factor in achieving this goal.
time monitoring & maintenance of equipment are also of major concerns. The advent of the fourth industrial revolution has provided tremendous opportunities for cobots in the smart manufacturing system. The manufacturing system has changed from a traditional system to a smart manufacturing system with the birth of essential technologies of Industry 4.0, such as IoT, artificial learning, Virtual Reality & Augmented Reality, drones, Machine Learning and edge computing. The cobots play a pivotal role by transforming the existing manufacturing system into a smart manufacturing system.

Cobots differ from traditional industrial robots as far as safety is concerned. The other factors are the short return of investments, shared workspace and payloads. Cobots reduce downtime by improving machine efficiency and sharing the workspace with the human workforce. It is safe to use, affordable and can be easily integrated with onboard computers and IoT. A cobot can perform difficult tasks by means of a flexible approach, be easily moved around due to its flexible 360-degrees of freedom and be easily deployed in the existing system without changing the layout of the shop floor. It can be applied to packaging & palletising, painting, coating, dipping, finishing, machine tending, material handling, visual tasks and assembly. Cobots are the boost engine for the ‘Make in India’ initiative and will reboot, rebuild, recreate and reinvent the existing manufacturing systems because of their flexibility in services that they can be applied to.

Case study I

New Engineering Works, Jamshedpur, Jharkhand, an SME established in 1996, is a pioneer in manufacturing hydraulic, pneumatic, engine and brake components for commercial vehicles, especially for automotive players such as Tata Motors, Ashok Leyland and Brakes India. The increase in demand for hydraulic and other components has made them shift to cobots on the shop floor and install six cobots in the production line. The company has witnessed an increase in their production by 40% and an increase in the workload 24x7.

Case study II

Craft and Teknik Industries, Pune, manufacturers of automotive components, who deployed cobots for automatic testing and CNC machine tending, found a 15-20% increase in production and are also aiming for a 30% increase in production.

Case study III

SMEW Textile Machinery, Ahmedabad, has been in the textile machine business manufacturing for more than six decades since 1958. In order to adapt to the latest technology
ANY ROBOT.
ANY GRIPPER.
ANY END-EFFECTOR.

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+ A system for lightweight robots and cobots
+ Automated exchange in the device
+ Manual exchange with easy-click function
+ Large variety of end effectors
+ Long service life, even in automated continuous operation
+ Combining the primary handling technologies (vacuum and mechanical gripping)

THE KNOW-HOW FACTORY
challenges and the competitive market, SMEW has implemented cobots and witnessed a 300% increase in the production of machineries.

**Cobots for silent factory: A case study**

Silent factories have made a major breakthrough and set a benchmark in the manufacturing system. Indian automobile manufacturer, Bajaj Auto, has transformed the Indian manufacturing ecosystem through the implantation of the silent factory for its electric two-wheelers production. The company has created a silent factory with the application of cobots, majorly for the manufacturing system. The cobots share the workspace and perform automated tasks. The advent of cobots has transformed traditional manufacturing into smart manufacturing. Bajaj auto has pioneered the workforce by successfully employing 50% of women workforce in its assembly lines.

**Intelligent, smart factory: A case study**

Havells India, a pioneer and market leader in electrical manufacturing production, has its fully automated AC manufacturing plant in Rajasthan designed on JIT. This plant manufactures one AC unit in 23 seconds. The manufacturing plant has Automated Guided Vehicles (AGVs) and has an in-house WiFi & IoT-based environment. The plant has 70 robotic points across the plant with the successful implementation of the Manufacturing Execution System (MES). The manufacturing is based on an intelligent system, especially through Artificial Intelligence-based I4.0.

**Reskilling & upskilling on I4.0**

In order to meet the demands of skill requirement for Industry 4.0, various sectors’ skill councils have been training the youth on the Industry 4.0 skills. Additionally, several associations, like the National Productivity Council, PHD Chamber of Commerce & Industry, ASSOCHAM and Quality Council of India, have been organising various training programmes on Industry 4.0 to train the manpower considering the promising future of the technologies. Reskilling and upskilling in Industry 4.0 will create employment opportunities, as this is the need of the hour.

**Industry 4.0 readiness tool for SMEs**

The primary requirement of SMEs to transform to Industry 4.0 is the preparedness or the readiness to implement the fourth industrial revolution technologies. In order to facilitate SMEs to make this manufacturing transformation, the Centre of Excellence on Industry 4.0 of National Productivity Council, Ministry of Commerce & Industry, Government of India, has developed a customised, digitalised tool to assess the present level of the digital readiness of SMEs. It is expressed as five maturity levels, described as Starter, Managed, Adaptive, Realizer, Top-Notch (SMART). The tool is smarter and has digitalised ways to assess the SME’s readiness to Industry 4.0, irrespective of the size, profile and manufacturing domain. The tool is categorised into three-point drivers such as manufacturing strategy, digitisation strategy & organisational strategy. The tool will provide additional inputs for the SMEs to identify the potential improvement areas as well.
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As the world recovers from the pandemic, four key supply chain trends are taking hold in the near term. The four themes include resilient and sustainable supply chains, Sales and Operations Execution (S&OE), extended value chain integration & end-to-end optimisation and what-if scenario analyses.

Supply chain resiliency is a key priority for governments. Chemical companies are looking towards sustainability targets to reduce energy use, emissions and waste while governments include green energy policies in economic recovery packages. A key takeaway post-pandemic is that sustainability and resiliency are two sides of the same coin. As such, supply chain digital twins can help manufacturers achieve their goals.

FPCO, Japan’s largest manufacturer of food containers and a logistics supplier, is one company that has achieved this critical balance. FPCO is committed to environmental advancement, as it avidly recycles used food containers and PET bottles. With more than a billion containers sold each month, selling recycled products needed to be an economically sustainable activity. The company chose AspenONE Supply Chain Management (SCM) to provide a stable and responsive food distribution in an efficient, sustainable as well as environment-friendly manner.
There are three core supply chain solution areas that can create meaningful change:

1. **Strategic manufacturing optimisation**: For example, the biggest cost optimisation saving opportunities are available when a company assesses or redesigns its production and distribution network – exploring options in manufacturing capabilities (flexibility) as well as raw materials sourcing. In doing so, an organisation has the ability to effectively prioritise capex decisions to achieve long-term sustainability metrics, evaluate alternate supply options and P&L impact, plan reshoring activities as well as design the best distribution network to minimise transportation inefficiencies.

2. **Sales and Operations Planning/Integrated Business Planning (S&OP/IBP)**: To achieve financial and sustainability metrics, plans should be based on forecasts and assumptions. This will optimise the end-to-end supply chain holistically by creating optimal plans to achieve financial and sustainability metrics. By optimising planning, the environmental impact of procurement can be reduced, and excess or slow-moving inventory can be minimised. Production and distribution plans can be created holistically to ensure that customer demand is met using the least number of resources.

3. **Sales and Operations Execution (S&OE)**: S&OE is the management of change by aligning supply chain and operations – that is, how one responds to and manages daily upsets.

**S&OE digital capabilities**

Manufacturers need to be more agile, which can be addressed by implementing S&OE processes and related digital solutions. S&OE is a process that allows manufacturers to align their day-to-day activities on an ongoing basis to achieve their longer-term Sales & Operations Plans (S&OP) while improving agility.

**Extended value chain integration and end-to-end optimisation**

Transportation fuels have historically been the biggest demand and end-use for crude oil. With energy transition underway, demand for transportation fuels is expected to peak, driven by more efficient combustion engine technologies and the transition to electric vehicles. As a result, refiners will shift their attention from transportation fuels demands to chemical demands, and as a target area for future growth, this megatrend is referred to as Crude-to-Chemicals (CTC).

When looking at the CTC extended value chain, there are two key areas with integration opportunities. The first is the integration of the oil refining and base petrochemicals supply
chains to exploit process and molecular synergies to shift from producing fuels to chemicals. The second is the integration of the base petrochemicals and downstream derivative chemicals supply chains. The opportunity here is linked to being more agile and specific in the monomers and polymers value chain planning integration as well as optimisation to best respond to changing supply/demand economic conditions across the extended olefins-to-derivatives value chain.

Managing and optimising a crude/olefins-to-polymers extended value chain is challenging, as it spans supply chains with very different characteristics. The intersection of bulk chemicals and polymers is where the demand-driven and the margin-driven sides of the value chain meet and interact.

The upstream refining and bulk chemicals businesses are margin-driven supply chains in which the optimisation opportunities consist of optimising the operating conditions of complex continuous production processes as well as exploiting feedstock supply and associated economics optionality.

The downstream polymers business is a demand-driven supply chain in which the optimisation opportunity consists of looking at the broader business system and determining the best way to balance supply and demand while maximising the profitability of this overall system.

What-if scenario analyses

The pandemic has highlighted the immense importance of what-if scenario analyses. Faced with tremendous uncertainty and complexity, the best way to face an uncertain future is by evaluating what-if scenarios to explore economically feasible alternatives. This is extremely valuable for business contingency planning purposes.

Unfortunately, most companies today still rely on inadequate spreadsheets rather than supply chain planning and scheduling optimisation digital twins. Spreadsheets are inadequate because they cannot adequately model process industry manufacturing and supply chain complexities and are not designed to do mathematical optimisation at scale.

At the core of a supply chain digital twin, there needs to be a representation of the manufacturing process. Multiple complexities may need to be factored into this model, such as production switching costs, utilities, minimum run sizes and so on. Modelling becomes even more challenging when one factors in other production or tolling sites as well as the dependencies across sites. As companies extend backwards from production into suppliers, there are aspects that should be modelled here as well, including different purchase minimums, costs and lead times varying by the supplier.

Finally, there is a downstream supply chain consisting of warehouses, distribution centres and customer ship-to locations. The situation can get complicated when one tries to factor in duties and tariffs or product substitution options, as it can be very challenging to model these interrelated elements in a spreadsheet – rather than using a solution designed specifically for that purpose.

The other big limitation of a spreadsheet is that it was not designed to do mathematical optimisations at scale to solve real-world problems – taking into consideration anywhere from tens of thousands to millions of variables and constraints.

Indeed, it is a post-pandemic imperative to accelerate supply chain profitability and sustainability with the latest technology the market can offer.
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“It is important to watch the dynamic response & trends of the industry”

...says Suresh D, CEO, Spark Minda Technical Center, Minda Corporation and Group Chief Technology Officer, Spark Minda Group Companies. Spark Minda is one of the automotive tier 1 companies in India with a strong manufacturing presence globally. In this interview with Juili Eklahare, he explains how simulation is a key enabler in the new era of product design & development, how the company has fought against the pandemic and the initiatives in automation & digitalisation deployed across its plants. Excerpts...

Spark Minda has a Research & Development centre in Chakan, Pune. How is the centre striving to strengthen and expand Minda Corporation’s presence as a complete system solutions provider for automotive systems? Spark Minda Technical Centre (SMIT), at its core, acts as the flagship bearer of technology innovations in legacy as well as non-legacy areas of the Spark Minda group. SMIT harnesses radical technologies to develop innovative, sustainable growth products, affordable solutions and offers value-added products & services to a wide range of prominent automotive customers. It has taken progressive steps in a phased manner to proliferate a culture of creativity & innovation for the development of highly competitive products. SMIT was founded to propel Spark Minda Group towards attaining technology leadership in the automotive sub-systems domain.

Minda Corporation, with Ansys, inaugurated the joint Centre of Excellence (CoE), SMIT, two years ago. How is the centre functioning in the current pandemic to create exemplary products and innovations? Could you cite some research innovations?

Simulation is a trend and a key enabler in the new era of product design and development. We are able to build strong skills in CAE, CFD and electromagnetic simulations. In our CoE, we can apply the power of virtual testing and simulation using these tools, which reduces considerable time in product development and improves the overall reliability of the product. We have multi-phased condensation simulation, motor design optimisation, complete virtual simulation in clusters testing etc, and some of the results came out well after applying such processes.

With the COVID-19 pandemic, several automotive industries are doing their bit in the country to fight the virus. What steps/measures has your company taken to help out? Spark Minda, along with Spark Minda foundation, provided first-hand support to affected members of our group and families on war footing. Within weeks, it was extended to even announcing and conducting a free vaccination drive for all employees along with providing online medical support to employees’ families. Other initiatives undertaken are the Ration Distribution Drive, COVID-19 Care Center setup in Gurugram & Plasma Donation Drive across numerous locations and the distribution of Arogya Health Kit to the destitute people.

Can you highlight the emerging trends in the new generation technologies, like connected, autonomous, electrified mobility solutions? The industry has aggressively shifted gears and set-forth to an ambitious new course, ‘CASE’ – a push towards Connected, Autonomous, Shared, Electric vehicles and mobility solutions. With such convergence, OEMs are working to reengineer their conventional platforms in a way that accommodates Electric Vehicle (EV) components, such as batteries, power electronics and motors. However, the industry’s transition from a vehicle-centric to a service-centric approach necessitates the development of new digital platforms. It is important to watch the dynamic response and trends of the industry, measure strengths...
& opportunities and then define a strategy. It is obvious that a customer-centric approach will help provide lots of data towards their expectations & roadmaps. Additionally, the end-user experience mapping is important to define the product scope and offering solutions to OEMs.

What do you think is truly needed to supplement & enhance the Aatmanirbhar Bharat & ‘Make in India’ initiatives in the auto component manufacturing sector?
From the outset, we must be clear with the end-goal and aspirations in a time bound manner. The industry seeks long-term planning in order to suitably invest & achieve the government’s ambition of Aatmanirbhar Bharat and ‘Make in India’. As an example, the BS-VI emission norms were welcomed very well in terms of the benefits to the environment. However, the learning is that the industry should have been taken into confidence well in advance for the entire value chain to prepare for the shift. This has eventually caused a huge financial impact to the industry and impacted the consumers, who ended up in a sticker-shock, due to the sudden increase in vehicle prices. We strongly believe that the development of the entire value chain (all tiers) is the key to any success that can be as much as a simple child part or an overall system solution.

Can you brief us on the initiatives in advanced automation and digitalisation technologies deployed in various manufacturing facilities of Spark Minda?
Spark Minda has established an excellent manufacturing engineering process and team in order to adopt the required automation for the products manufactured across our plants. Additionally, the team is working with various new age digital tools, smart machines, digital warehousing systems & automation that feature end-to-end integration, including inbound & outbound logistics, production, marketing and services.

COVID-19 has triggered the semi-conductor chip shortage. What impact does it have on the automotive production facility?
Global semiconductor shortage that began in the first quarter of 2021 has halted assembly lines around the world, as the long lead time for semiconductor components has slowed manufacturing and thus, reduced the expected revenue for FY 2021 by billions of dollars. While every auto maker is affected by this issue, most players have dealt with it by raising costs and the careful allocation by semiconductor vendors. Some vendors are asking for a huge lead time in deliveries, thereby pushing tier 1s to look for alternate solutions. Frankly saying, today’s solutions business is ad hoc and rests entirely on the negotiations with vendors on supplies. A permanent solution can be achieved by introducing collective parts in the future (meaning multiple components meeting the same specification) which will have better flexibility of manufacturing. All of this can lead to an overall reduction in production numbers and an increase of non-production days, for some cases.

How are Indian automotive manufacturers coping to this challenge?
It is extremely challenging for OEMs and tier 1s to find a solution. Overall, the agility in change management is the key to overcome such consequences with the help of substitutes, although empathy towards the reliability requirements in automotive and a thorough product testing in labs & on the roads will be important before implementing an alternative. Some solutions, like accelerated testing methods, simulations etc, can help reduce the lead time for such consequential alterations. In most cases, though, OEMs understand such issues and support the tier 1s with the negotiation with semiconductor vendors or introduce alternate parts within a short span of time.

Suresh D is a BE in Electronics & Communication Engineering from Bharathiyar University, Coimbatore, Tamil Nadu. He has over 25 years of rich experience in the field of engineering, business solutions, engineering services, etc. His expertise includes automotive embedded systems, powertrain systems, electronic fuel injection and more.
When the chips are down...
Coping with the shortage

Semiconductor chips – an integral part of today’s automotives which enable high-end electronic capabilities – are running low in the Indian market. The delay in lead time (the gap between when the chip is ordered & delivered) can be attributed to various factors, some COVID related and some not. The Viewpoint reveals the triggers that led to the shortage, its impact, how manufacturers can cope with the shortage and, finally, if India is ready and should venture into the semiconductor manufacturing domain.

“The automotive JIT does not correlate with the long semiconductor manufacturing cycles”

The current automotive chip crisis has several root causes. Next-gen E/E architectures with increasing processor performance for ADAS features, connectivity and SW defined functionality, as well as the electrification of vehicles, are driving demand. The strong COVID recovery has resulted in a demand spike in the automotive industry as well as in other competing industries such as consumer electronics, crypto-currency mining, power electronics for clean energy applications, etc. The ‘hardball’ tactics of some OEMs during the onset of the COVID crisis that reduced volumes drastically led to a reallocation of supplier capacity in other industries, which is not easily reversible. Combined with long lead times for fab production facilities, this leads to a situation where the semiconductor shortage will impact production beyond 2021. The automotive just-in-time does not correlate with the long semiconductor manufacturing cycles, and capacity will remain restricted in the medium term. At the same time, the supply base for leading nodes will rely on very few (2+) suppliers with large geographic and political risks.

In the near term, automotive OEMs must avoid line stoppages and prioritise program management as well as supply chain transparency. In the mid- and long-term, advanced commodity and supplier management techniques must limit supply chain risks. Long-term, multiple levers such as strategic/equity relations with SemCos, design standardisation and consumerisation for non-mission-critical domains are relevant levers for OEMs and tier 1s.
“India can start with ATMP and eventually enter speciality fabs”
Semiconductor chips are mostly procured on a just-in-time basis for automakers. Due to the lockdown and low demand from automakers, chip manufacturers focused on the growing electronics industry. This led to a supply crunch of chips for automakers, as the existing inventories got exhausted with the revival in vehicle demand. Due to the shortage, automakers will have to delay the new model launches, increase the delivery time of existing products and reduce the features from the models that require chips not present in inventory. In the future, automakers could diversify their suppliers’ geographies to avoid a freeze on manufacturing plans.

As chip manufacturing is an advanced technology, India will be starting with a lag. India can start with Assembly, Testing, Marking and Packaging (ATMP), which generates higher employments and requires less investment. Eventually, we can aim to enter the speciality fabs, as it will be easier to catch up with other countries. The Ministry of Electronics and IT is also expected to develop policies for increasing semiconductor manufacturing in the country.

“Plan ahead with the greatest amount of foresight and inventory forecast”
The chip shortage has a significant impact on the timelines, lead time and cost. The impact cascades through the ecosystem, leading to delay in the production schedule and the inability to meet business targets. As Indian automotive manufacturers are dependent on imports of either all the electronic components or the microcontroller & semiconductor chips, the only option is to plan ahead with the greatest amount of foresight and inventory forecast. This leads to taking business risks related to the actual content of such semiconductors in the vehicle.

India has missed the bus and is trailing behind semiconductor manufacturing nations. The need of the hour is to establish a strong manufacturing base in India for semiconductor, electronics and digital systems. With the evolving digital front and an emerging Asian market, we need to create a strategic position in this segment. Along with subsidising capital investments in semiconductor manufacturing, we need to focus on the development part, build an ecosystem, promote common facilities and bridge the demand & supply systems.

“The semiconductor industry thrives on diversity and interdependence”
Due to the chip shortage, the growth of cars and high-end bikes will get impacted, although both segments are poised to grow this year. With the announcements by many silicon players in the last several quarters, we will see the supply-demand gap reduce not only because of the commissioning of new fabs but also due to the increased productivity and efficiency of the existing fabs.

We are trying to get allocations of parts that are under high lead times as a short-term solution until the supply-demand gap evens out. There will be challenges for the next four to six quarters, but the industry will find out innovative ways to tide over the problems. The semiconductor industry thrives on diversity and interdependence. No country in this world can claim to be completely self-reliant or self-dependent in this space. There will be some sectors of national importance where one will see activity to be less dependent. But overall, countries will need each other to thrive and succeed, and everyone needs to focus on their strengths.
The many waves, mutations and lockdowns caused scarcity of semiconductor chips – an essential for sophisticated electronic prowess in cars and bikes. In addition, the shortage brought delays and complex engineering issues to either replace or substitute the semiconductor chips. It has had a cascading effect causing delays due to the slow supply. The automotive industry needs to prepare for this shortage and accept a slowdown. They will experience losses and delays because the shortage is not under the control of anyone but the parts manufacturers, who also face troubles due to this pandemic.

Indian manufacturers have scope for growth right now, no doubt. It is a good opportunity for small-scale manufacturers and engineering start-ups to innovate and produce products at par with the chip manufacturing countries. The possibility of finding something more locally designed and produced does also mean that the automotive industry will need to adapt its vehicle design with these units. The innovation that comes out of this crisis will be one to reckon with if all kinds work right.

“For real Aatmanirbharta, increase the overall attractiveness of the Indian market”

A Susquehanna Financial Group report pointed out the chip lead time – the time gap between a chip’s order and its delivery – of up to 17 weeks in April 2021. This resulted in several carmakers & high-end bikemakers to lower their inventory holdings and depend upon the supply chain to dictate the production pace. In comparison to smaller companies relying on retailers, the demand-supply gap is vast for bigger manufacturers. A well-considered design release programme coupled with long-term supply contracts can go a long way in alleviating such supply chain issues.

Presently, India offers no strategic or tactical advantages to any company considering a chip manufacturing facility. Because of the multi-billion-dollar cost and small domestic demand, the only way such a plant can come in India is if the government decides to rejuvenate its efforts in a joint venture with major worldwide manufacturers. Besides, just a 'fab plant' will not bring about complete Aatmanirbharta in this field. Perhaps, the best way to attain real Aatmanirbharta is by increasing the overall attractiveness of the Indian market so that major manufacturers make a beeline to sell here.
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Energy-efficient companies can gain a competitive lead over companies still reliant on fossil fuels, leading to a better environmental performance. Where we live in a world of growing energy demand, energy distribution plays a pivotal role, where the effective operation of available resources are the driving forces towards energy management. This article discusses how automation has become an integral part of the energy industry, the role data plays and the significance of a transactive energy approach.

Energy distribution systems, an inter-networked and intricately balanced collection of sources & load are experiencing a time of unprecedented change. Following decades of under investment, energy systems have become a priority area to address local issues of critical infrastructure rebuilding & resiliency as well as customer empowerment while also supporting the wider goals of climate change, energy sustainability and economic development.

Automation, which is an inherently data-driven effort, has become an integral part of the energy industry. Evolving from pneumatically-driven components designed to mimic manual human actions, initially, automation was implemented through relay logic or a series of standalone controllers, depending on the industry sector. Today, programmable controllers and protection devices are almost ubiquitous through the industry – used for data collection, breaker reclosing, metering points and everything up to full plant & system control. This has a number of results – the first is that it challenges staff to develop new skills. The second is that it allows for remote visibility and operations of facilities. The
third is that it enables data collection, which sets the stage for welcoming the next industrial revolution of cyber-physical systems and AI. However, these essential systems also open new cybersecurity risks, create dependence on communications infrastructure and challenge traditional architectures.

Distributed Energy Resources (DER)

Power plants made their debut in the 18th century and were initially controlled either manually or through the use of mechanical automation. As technology advanced, the means to maintain the stability of the system and to protect the equipment also advanced. Automation has evolved through manual, pneumatic, electric and now programmable means of control. This advancement has been spurred by technology & the industrial revolutions and has generated positive changes within the industry. However, now we are embarking upon a different set of changes – the thought process underpinning the planning and distribution of energy is changing. Although we will likely still have large centralised harvesting centres close to the energy sources that capitalise on networks of transmission and distribution infrastructure to deliver the product to customers, there is a shift taking place towards the acceptance, use & deployment of Distributed Energy Resources (DER). This shift moves energy harvesting closer to the user, reduces the dependence on costly & vulnerable transmission systems and transforms distribution systems into bidirectional networks.

What data does

Programmable automation systems started out with limited I/O, only collecting data from sensors and transmitters connected via voltage and current signals to costly centralised processors for interpretation, calculation and storage. Modern automation systems also have the ability to be distributed, placing I/O, processing, and in many cases, intelligence in the field using both distributed I/O systems, networked processors and edge devices. IIoT-enabled devices and standardised communications protocols have not only streamlined the manner in which data is organised, formatted and collected, but have also enabled the collection of greater amounts of data. Currently, systems collect all of this data, serve it up for real-time and short-term trending functions and then send it off to longer-term storage. Having all of this data stored in a data historian, data warehouse or data lake allows visualisation and analysis. It empowers the organisation to identify patterns and correlations in the data which triggers action. This provides the foundation for data-hungry advances, such as Machine Learning, predictive control, mixed reality and AI applications. Enterprises, now, have the unprecedented ability to automate both industrial and business processes. Prosumers now have the ability to both produce and consume energy on the same network, all monitored, controlled and regulated by IIoT-enabled edge devices feeding optimised system models to determine needs, constraints and pricing. In addition to this, the increased level of data inflow also provides support to additional functions within the energy ecosystem.

A transactive energy approach

To use an example to illustrate, most energy companies are asset-intensive organisations. These assets require time and effort to ensure that they are in optimal working condition to deliver energy to consumers. Starting at the equipment level, Machine Learning algorithms, such as decision trees, fed from real operating data, have the ability to optimise the operation of the equipment and hence, the operation of the system overall. Additionally, similar algorithms can be used to extend preventative maintenance programmes into predictive maintenance programmes, which have the potential to cut costs, which is immediately reflected in the bottom line. If we collect all of the decision trees within the maintenance programmes for the equipment, then we have a random forest to deploy the asset management programme. Furthermore, ensuring that all assets are kept in the best operating condition possible ensures that availability is maximised. This sets the stage to develop and implement economic and control mechanisms that allow the dynamic balancing of supply and demand – a transactive market. A transactive energy approach provides greater efficiency of usage of grid assets, including generation and storage. Additionally, it also provides greater resilience and
reliability while engaging the consumer by providing them with a choice. Traditionally, the realm of large utilities and enterprises, now individuals would have the ability to transact on the market with the resources available to them. Automation provides the marginal pricing, time shifting and the ability to maximise the use of assets, not to mention the optimisation. The convergence of IT and OT systems allows transactions to be automated in the background, allowing energy to be generated and delivered in exchange for value. This continues until a sufficient supply is established to stabilise pricing and satisfy demand. Although prosumer ownership of renewables works well on the electrical side, it is not as common in other areas of energy. Consequently, we see Energy-as-a-Service models being established by manufacturers, consultants and utilities. This concept is already being used with Virtual Power Plants (VPP), whereby, the utility owns the generation and interconnection infrastructure placed in a distributed fashion across residential rooftops and simply rents the rooftop space from consumers. The utility uses the energy generated to offset purchased power, and the homeowner receives a steady income source from the utility.

**The path forward**

Where does this leave us? The energy industry will continue to evolve. It has always been dynamic, fearless and willing to be at the edge of technology. There are many advancements that have already started, such as VPPs, that will continue to be innovative within the industry. We have been seeing the convergence of IT and OT for some time now with the introduction of client/server technology, thin clients, virtualisation and ‘as a Service’ models into the automation world. These technologies both supply greater levels of data and also provide access to a wider range of data sources to the automation system, which, in turn, allows for more accurate predictions and better decision-making. This is complemented with OT advancements, such as two-wire Ethernet and modern standardised IP-based communications protocols. Data lakes & data warehouses are being implemented to capture and store the new levels of data being generated and cloud-based infrastructure will enable & simplify analysis and processing of the data. Companies look to Machine Learning & Machine Learning algorithms to identify patterns within their data and manage & understand the information in addition to making predictions regarding courses of action. Digital twins are being used to plan, design and test systems prior to implementation to reduce the time from concept to production. When combined with technology, such as Augmented Reality (AR), they can form a powerful diagnostic and troubleshooting tool that is safe and allows technical staff to diagnose & understand issues before arriving on-site, thus ensuring that they carry appropriate tooling and safety equipment with them so that outage time is reduced & safety is increased.

**Entering an age of intelligent machines**

Artificial Intelligence, Machine Learning and AR will continue to be applied to new situations and other areas of the energy value chain. While I foresee an industry that will evolve with and embrace the technology of today & tomorrow, the industry has to adapt quickly to new technologies and innovations while tempering the implementations with common sense so as to observe ethical data practices as we enter the age of intelligent machines. ☐
Future-proofing collaboration: Combining robots and machine vision

‘Lights out’ factory of tomorrow allows industries to capitalise on the latest developments in vision and robotic control for quality control. In a similar endeavour to create factories of tomorrow, IVS created a fully automated vision inspection system for Kawasaki Precision Machinery (KPM). The case study explains how IVS combined Artificial Intelligence machine vision with cutting-edge robot automation to provide state-of-the-art flexible automated vision inspection cells for the factory of tomorrow.

IVS has combined Artificial Intelligence machine vision with cutting-edge robot automation to provide a state-of-the-art, flexible automated vision inspection cell. High-definition camera technology combined with LED lighting and laser projectors allows large products to be inspected at speed with high precision, reducing the need for inspection operators in automated production lines. Such solutions are critical to driving productivity within manufacturing and driving towards fully flexible manufacturing & Industry 4.0 production control.

The challenges in inspection

Kawasaki Precision Machinery (KPM) approached IVS to develop a fully automated vision inspection system for multiple parts on their dual pump assembly line. In total, six different parts, with a total of 63 variants, required precision inspection. Historically a human operator would be used to inspect such parts, but even if 200% manual inspection was utilised, quality could not have been assured. The parts included stoppers, needle bearings, valve plates and three...
different shafts. The inspection criteria included measuring parts for tolerance checks, verification of the correct types and presence verification of critical build components.

A large number of parts and variants presented a common problem in the world of automated vision inspection, as most systems were designed to inspect only a single part with minimal variants. Creating flexibility in a system’s capability would generally require adding equipment and complexity to the system in the form of supplementary sensors, actuators, controllers and tooling – not to mention the additional programming and system training. All of these complexities further added exponential costs to projects, often making the single, ‘all inclusive’ solution more expensive than several ‘individual part’ solutions. Due to manufacturing floor space constraints, KPM wanted a single, highly flexible vision inspection machine to inspect all six parts and their corresponding variants automatically. KPM also planned to add more parts and variants to the inspection and assembly line in the future. This is also a common issue in the industry as automotive designs are frequently changed and improved. If the changes are minimal, the solution is generally straightforward. Slight changes in check routine programming make it possible to inspect the ‘new’ parts. However, inspecting a completely different part (i.e., gear vs shaft) can prove to be extremely difficult and costly, if not impossible.

IVS was dedicated to designing and building a single system for KPM that could inspect all six parts and 63 variants as well as any future parts and variants that KPM would incorporate.

The perfect collaborative engineering

IVS did engineer vision systems in the past that involved rotary actuators and linear slides to position vision systems for inspection at different points on a part. However, it still required several cameras and actuators to inspect a single part, often allowing for no additional part variant changes in the future. Therefore, providing the ‘eyes’ for a robot to inspect the part was the latest innovation from the company. The new machine vision solutions utilised Artificial Intelligence machine vision algorithms to allow the robot vision to ‘learn’ the difference between good and bad parts. As the vision sees more samples, the variations in products are learnt by the system, and the system improves when enough samples have been seen, the system runs autonomously, making decisions on the part acceptance or failure for quality.

It was clear to the IVS team that using a collaborative robot (cobot) was the perfect solution. By integrating a six-axis robot into the vision inspection system, IVS eliminated the need for multiple cameras and the actuators that moved these cameras around. The robot could position the camera head at almost any angle in almost any position, allowing complete three-dimensional checks of the parts. The camera system was further combined with both laser projection and standard LED lighting technology, which allowed multiple analysis of both standard images and laser edge detection.

The output adjudged

Using the robot allowed a single vision machine to inspect endless parts and variants. This made the inspection system future-proof as KPM could add new parts and variants to the system capabilities at their leisure. IVS designed a complete
machine that fitted in the production line upstream of a part pressing process. An operator loads the parts to be inspected on a pallet and the pallet was driven to the input side of the machine’s conveyor. When prompted, the machine moved the pallet into the inspection cell surrounded by tinted in-fill panels for operator safety. The robot positioned the camera in several places for the vision system to determine what part was present and what inspection sequence to run. Once the specific part and variation were determined, the inspection machine performed all the checks for that particular component based on its prescribed check routine.

Once complete, the factory information system was notified of the pass/fail outcome of the part and the reason for any failures. The pallet was then moved out of the inspection cell automatically on the outfeed of the conveyor. IVS had supplied the operator and engineer training to KPM, which allowed KPM employees to program and test new parts and variants in the inspection system. IVS had successfully supplied KPM with a vision inspection machine that met all their needs and more. The vision inspection machine fit within the new production line and fed directly to the downstream processes, eliminating the need to reconfigure the manufacturing line set-up. By reducing the operator intervention for the inspection process, IVS helped KPM guarantee 100% defect-free product to their customer.

Collaborating KPM with the future

The flexible vision cell is future-proof; KPM can program the machine and robot to inspect countless parts and part variants. IVS developed the check routines to be independent of the factory communication system or operator input, allowing the machine to determine what part is presented before performing the checks. This removes the potential for operator or communication system error of misinforming the machine of what part has been loaded for inspection. Operator safety has taken a key role in the design and build of the machine. Emergency stop buttons are located at multiple points on the machine, and the inspection cell is completely enclosed by tinted in-fills to protect both operator limbs and eyes. In addition, the robot is human collaborative, meaning it is safe for humans to interact with and will stop its movements if it feels an external force acting upon it. Not only does the vision machine automate the inspection process, removing the human error element, but it also decreases inspection time decreasing overall production time, whilst at the same time guaranteeing quality. An operator would never be able to cope with the inspection of a large number of variants at a consistent level.

By designing a single machine for all the parts and variants, IVS eliminated the need for four separate machines to cover the six different parts. IVS developed a first-of-its-kind automated inspection cell that met all their needs and more. The vision inspection machine fit within the new production line and fed directly to the downstream processes, eliminating the need to reconfigure the manufacturing line set-up. By reducing the operator intervention for the inspection process, IVS helped KPM guarantee 100% defect-free product to their customer.

Credits: Industrial Vision Systems (IVS)
To read more, visit: www.industrialvision.co.uk
Fieldbus and networking application in the manufacturing industry

In the last two decades, fieldbus has transformed the method of communication in the manufacturing industry. The article talks about the different facets of fieldbus technology, including design, wiring, induction, and commissioning as well as safety prospects within the hostile application areas.

During the last two decades, fieldbus has completely transformed the way communication takes place in the fields of manufacturing industries. The contemporary launch of real-time fieldbuses has opened up its functionality within the multi-axis motor control and other time-critical applications. Fieldbus has been primarily designed to establish easy interoperation, smarter network designs, increased data accessibility and minimised stress on the design facets of safety protocols.

It has been observed that we often use Ethernet LAN for all our regular connectivity in our offices, so why do manufacturing industries not follow the same protocol? In this contemporary era of Industry 4.0, where connectivity plays an integral role, and IIoT is on every program, how beneficial are the fieldbuses? If there are so many available fieldbuses, how do control elements manage to communicate with one another? Or how is the serious topic of interoperability addressed?

The primary objective of a fieldbus was to restore any point-to-point links between sensors to PLCs or CNCs or other controllers. The fieldbus further explains the electrical features of the connection and also demonstrates the protocol. With the presence of flexible electronic modules, the attention...
to electrical characteristics has diminished, and observation of protocols has seen a surge.

**Electrical features, protocol & standardisation**

Fieldbuses can be further undisclosed by several features or characteristics. Mostly under this circumstance, one checks for speed (bit-rate), number of nodes authorised (single-master, multi-master), flexibility in topology (linear, multidrop, ring, tree, star), enhanced presence (redundancy), methods of data seizing (polling, cyclical, event initiated), how new nodes can be implemented (system reset, on-the-fly), how fall-out of one or more nodes can be distinguished and corresponding recovery processes and so on.

The process of communication protocols is the set of rules and regulations which helps to further define the different syntax elements and the ‘grammar’ – the position of all the present elements, the recognised values and the importance of the same. By following a certain kind of protocol, it becomes easily possible to commence a particular communication, various flag errors in communication, analyse a broken communication and come up with a suitable solution to recover from the break. Also, to be more specific, communication protocols should be made common across vendors to make their job of maintenance and spares easy.

Yet, the world of fieldbuses is a genuine Tower of Babel, and the species and sub-species of protocols that are categorised can easily be analysed with the same branch, mostly not quite compatible with each other.

**Why are there so many fieldbuses available?**

It has been observed that due to the massively diversified variety of application areas and equally varied demand on the properties, a large number of fieldbuses have sprung up. As a result, manufacturers usually define and develop their process in order to attain the best execution process from their products.

The various diverse application areas that are available in this area are process plants, building automation, discrete manufacturing and, to some smaller extent, safety automation, and also, sub-species emerged from specific industries, like power generation, oil & gas, automobiles, breweries, and so on. The area of sensors (this was called the ‘field’ and hence, comes the name, fieldbus) certainly have their buses that various manufacturers are significantly using.

**Achieving interoperability**

As we all further explore the world, along the process of intoning, there are just too many protocols for comfort available. But essentially, what is desired in this process is interoperability. That means no matter what bus proactively runs as the backbone in the plant, a sense of freedom should be available to continue to buy and connect a device from any vendor, and the system should be further able to talk to this new device and vice-versa.

The fascinating aspect of this particular process is that interoperability can be achieved at various levels. Here what we can do is, we can take some relevant reference model from ISO, the famous seven-layer model. The communication stack is abstracted into seven layers – a standard called The Basic Reference Model for Open Systems Interconnection. What’s more, we can show interoperability for two devices at any one or more of the seven layers. The task of protocol conversion gets shifted to the next higher level.
Standard protocols

Over a period of time, many endeavours were initiated to appear at a standard protocol. This gave rise to many ‘standard’ protocols – vendors’ standard protocols, buyers’ standard protocols, industry body standard protocols. However, for a few organisations, the usual association of vendor manufacturers has evolved standards – which means an agreement among their members has been mutually done. In the further detailed nature of things, these members, after achieving the mutual agreement, go ahead and, during the implementation process, provide an ultimate additional feature of their own to give special benefits. Unfortunately, these add-ons prevent complete interoperability.

Open protocols & focus of Industry 4.0

A different approach is to provide the entire protocol stack in the public domain. With this, every manufacturer has a possibility to incorporate compatibility into his devices with such a protocol without having to pay any license or royalty fees. The open-source approach has many enthusiastic followers. But if manufacturers would push in add-on features on the top of this definition, once again, we have some incompatibility.

Besides, Industry 4.0 is a new era in manufacturing and business. The focus of today is to extract value out of data for various purposes. One important strategy is the aggregation of data from various sources and recording it together with the context of data creation.

Interplay with data systems

In this era of Industry 4.0, we are hungry for data. The requirement of data for these purposes is very different from the real-time deterministic demands of operation and control. However, the data sources are quite nearly the same, so we should see many changes in the times to come. Since Industry 4.0 lays a strong emphasis on collaboration end-to-end along the value chain, there has to evolve better ways to share data. The emergence of the Industrial Internet of Things (IIoT) and new possibilities for connectivity with wireless and ethernet are changing the protocol landscape. New value in integrating public and private enterprise clouds, operational systems and business domains present new protocol harmonisation opportunities in industrial environments. Deployment of wireless in the shop floor is in the beginning stages. A number of protocols have already sprung up, such as LoRA, ZigBee, Wireless HART etc.
Realising the immediate and future benefits of digital transformation

Change is the only constant, and the evolving manufacturing industry is a testament to this. Digitalisation has turned into a radical phenomenon, without which one will lose out on business and eventually cease to exist. The article explores how manufacturers can properly leverage IIoT and connect islands of automation, unlock trapped machine data and empower their workers to deliver greater value.

The devastating effects of the global pandemic have radically changed the way we live and work. Manufacturers are no exception. In addition to the competitive pressures they faced before the pandemic, their day-to-day operations also include remote workforces, social distancing and reduced labour efficiency. However, these concerns coincide with the era of digital transformation in manufacturing, a time that promises ever-greater reliability, efficiency and sustainability. By leveraging the Industrial Internet of Things (IIoT), manufacturers can effectively face — and overcome — compounding challenges today and positively transform their operations for the long term.

Answering today’s pressures and demands

In addition to the pandemic-related challenges, new technologies, the environmental crisis, labour shortages and operational efficiency have concerned manufacturers for some time. The first step to solving these intersecting pressures now and in the future is by fully comprehending...
them. The great variety of connectivity and analytic options in hydraulic, pneumatic and electric motion systems is both exciting and staggering. However, while these new technologies offer the opportunity for operational improvement, they must be properly integrated and adopted for manufacturers to realise their full benefit.

One benefit such connected, monitoring technologies often provide is improved Overall Equipment Effectiveness (OEE). This is achieved through real-time, intimate knowledge of individual devices, their health and related processes. By analysing data and making decisions that maximise the productivity of each machine, manufacturers can better understand how to improve overall efficiency and reduce costs. In addition to improved efficiency, digital transformation solutions can also attract a younger generation familiar with dashboards, as the ageing workforce, along with its wealth of knowledge and experience, leaves manufacturing facilities. The data and insights these solutions provide can make it possible for this younger, digitally native workforce to enter the factory floor with more confidence and ease.

The remote capabilities of digital transformation solutions provide comfort and ease in another way, too. As COVID-19 has resulted in the need to reduce unnecessary foot traffic and person-to-person exposure, manufacturers have responded with social distancing practices, remote workforces and other protective measures that have reduced labour efficiency. Digital transformation can help manufacturers adjust manual and time-intensive, in-person work processes to be safer and more efficient.

Process efficiencies can also translate into energy efficiencies. Today, sustainable practices are no longer optional; helping customers reduce their carbon footprint and achieve their sustainability goals is expected. Manufacturing practices that use excess energy and generate waste by running systems out of range, for instance, are unnecessary and unacceptable.

Digitally transforming operations

In a typical manufacturing facility, dozens of machines work together to create a finished product, and inefficiency in one can affect the others. By connecting these individual machine ‘islands’ and the data they provide, operators can identify any machine inefficiencies and respond to potential issues before they can become larger problems.

While gathering data is an important part of connecting these islands of information, it’s not the only part. It starts with establishing a scope that is reasonable and understandable. Once parameters have been selected and the resulting data has been gathered, the most valuable insights are extracted. These insights form a clearer, more complete picture of operations that helps operators make informed decisions.

For example, for manufacturing plants that depend on pneumatic operations, the benefits of digital transformation are realised most effectively by monitoring air usage within systems — a scalable process that can easily be accomplished on just a few machines. When sensors, like Emerson’s AVENTICSTM Series AF2, measure airflow, the system can pinpoint the equipment experiencing issues and deliver notifications directly to the maintenance staff. By starting at an individualised, machine level, operators can obtain actionable insights.
insights without heavy data analysis — and very quickly lower costs, improve production quality, increase throughput and, in the case of pneumatic systems, improve sustainability.

Achieving the benefits of digital transformation today and tomorrow

The valuable information that digital transformation provides empowers manufacturers to ready their operations for future challenges while realising a quantifiable return on investment (ROI) within a year. However, success hinges on the right partnership. To effectively support digital transformation, it’s important to work with an experienced device manufacturer that knows the most appropriate solution to implement for a manufacturer’s unique needs.

The ideal partner will have a clear understanding of a manufacturer’s long-term vision, not just individual devices, gateways, cloud services or other singular systems. Manufacturers should also expect their device partners to assist with scoping a solution, including ROI estimates, device implementation, start-up commissioning and long-term support. By focusing on a specific problem or challenge, they can help the manufacturer control the initial project scope to quantify the results easily. This scope can also narrow down the most effective devices that can scale for potential needs and expectations, minimising the need for additional devices in the future.

Together with scalability, device flexibility is critical. It’s important to choose devices that rely on open communication systems and architectures. With how quickly the industry is evolving, being locked into a proprietary solution can prevent an operator from taking advantage of the latest technologies.

In the fluid power and motion control sector, there is not yet a single, industry-wide set of IIoT standards, so it’s crucial for any solution to be as open and flexible as possible.

In addition to compatibility, technologies and solutions that use open IIoT protocols also make it easier to gather and share information. A manufacturer should look for edge devices that, in tandem with open protocols, can handle various technologies to help avoid unnecessary complexity in either operations or system architectures. The Emerson RXi2-LP industrial PC is one such device with vendor-agnostic PACEdge software that runs nondeterministic applications to reduce latency and meet a variety of application-performance needs (Image 2).

As many manufacturers begin their journey to digital transformation, most IIoT applications are focused on streamlining maintenance, increasing efficiency and monitoring processes. But over time, the discussion will shift to become less about the devices and more about the insights they can deliver. What will matter is how a device manufacturer can help an operator maximise their IIoT investment and release the generated data. As a result, IIoT-powered intelligence will become accessible to more businesses, and the companies that have not digitally transformed will be left behind.

As we find ourselves at the intersection of a changing world and ongoing competitive pressures, it’s time to reimagine old methods and leverage the power of digital transformation. Operations can then advance with greater confidence and a renewed ability to meet the needs of today and the future. ☐
Disruptive digital technologies in the chemical industry

The Indian chemical industry has been a major contributor to the country’s GDP. While digital transformation has been rampant in the manufacturing industry, the chemicals industry would also reap significant benefits by implementing it across its factory units. The article studies the breakthroughs various digital technologies can bring in the chemicals sector.

The Indian chemical industry is one of the major contributors to the Indian economy, contributing 7% of the country’s GDP and is expected to reach $304 billion by 2025, registering a CAGR of 9.3%. It contributes to almost every manufactured product and serves as the backbone of many end-market industries, such as agriculture, automotive, construction and pharmaceuticals. Not to mention, the digital transformation in the chemical industry can’t be ignored, as it has potentially transformed the chemical industry by promoting strategic growth and streamlining operations through automation and digitisation, and there is a long way to go.

The chemical industry has witnessed a new wave of digitisation in this COVID-19 era, as various digital technologies are being rapidly adopted by chemical companies in the hope of driving innovation, profitability and staying ahead within the industry. Today, the companies require real-time data that allows chemical providers to run their businesses in an online world as well. Automation has greatly helped in cutting down on inefficiencies across the manufacturing and chemical sectors alike. Let us now look at some of the disruptive digital technologies that have brought breakthroughs in the chemical industry globally.
Industrial Internet of Things (IIoT)

Digital technologies, like IIoT, provide an enhanced insight on operations and capabilities of production systems, enabling greater visibility on status and integration as well as a deep exploration of alternatives to aid operational decision making. With the advent of IIoT, there is a further scope to accelerate operational excellence in the manufacturing areas.

One of the key advantages of IIoT is that it provides actionable insights to the key stakeholders, which help them take proactive decisions. Data-driven actionable insights help make operations more predictable and avoid surprises. This has a positive impact on efficiency, yield, uptime and other critical KPIs. But IIoT, an untapped source in the chemical industry, can greatly benefit the chemical companies in ensuring a competitive edge, safety and compliance regulations in the chemical industry. Moreover, IIoT delivers significant efficiency improvements to production processes. In the chemical industry, IIoT can serve as a base platform to create an intelligent network of devices that can interrelate data and processes to effectively establish feedback control systems within the context of industrial automation, which will further enhance interconnectivity, versatility, scalability, time efficiency, cost-effectiveness, security, productivity and operational efficiency.

Digital twins

Digital twins are yet another digital technology that can help train operators in atypical operations, especially in start-ups, shutdowns, slowdowns and other unexpected events. Such training is crucial to avoid potentially dangerous situations that can further lead to environmental incidents.

Plant level digital twins greatly help in the optimisation of potential manufacturing conditions, suggesting decreased production rates and alternate raw material environments, which ultimately adds to the readiness of several industries to face any crisis. Moreover, a digital twin would also enable chemical operators to create a unique environment to look at all their complex processes and suggest optimum solutions.

Data analytics

The use of data science and analytics has increased significantly in the chemical industry. The industry is quickly moving towards automation as it is an evergreen field that finds its use in every industry. There are a lot of recording failures in the chemical industry, errors in parameter recording that can sabotage various simulations and processes. In such situations, data science and analytics come to the rescue by providing immediate solutions, such as assisting in the rapid identification of trends and patterns, an absolute necessity in the case chemical industry to recheck a finding and reducing human effort, which means fewer errors and lower costs. Data analytics also makes it possible to achieve proficiency in a complex & unpredictable setting due to its ability to deal with multi-dimensional and multi-variety data efficiently.

Data science and analytics can further help chemical companies analyse their logs and look at the top risks that can emerge out of the data. Thus, giving us predictability, helping us take action and lessen the chances of such incidents happening.

Artificial Intelligence

Chemical industries are currently confronted with several difficult issues, including high energy use, hazardous risk assessment and environmental policy, which compel the industry and research institutions to develop new technologies, catalysts and materials. Process management techniques currently in use are incapable of dealing with dynamic situations in which process dynamics can change at any time due to organisational changes.

Machine Learning and Artificial Intelligence (AI) are two powerful advances in computer science engineering technology that can offer a plethora of benefits to the chemical
industry. They can help achieve strong catalysts, precise control over the running processes and optimum planning & operation schemes possible.

Deep learning, a great AI technique, aids in recognising activity modes, detecting faults and analysing risks in the petroleum refining processes. Deep learning can be very useful in training the reactors to maintain sufficient product concentration and flow using historical data on inflow, concentration, liquid level and outflow. When compared to conventional control loops, Big Data and AI can provide better process control. Statistical machine learning and evolutionary computation can prove critical for the characterisation of petroleum products, chemical change modelling, process optimisation, decision-making, environmental understanding and automated troubleshooting of a wide range of problems in the chemical industry.

Cybersecurity

Chemical sites and related infrastructures, where significant amounts of hazardous materials are manufactured, stored or transported, are increasingly vulnerable to security threats. And, as a result of the lockdown and social distancing steps introduced during the coronavirus pandemic, the shift to more widespread home working in a compressed timeframe has spread company networks wider than they have ever been, exposing a slew of vulnerabilities that hackers are looking to exploit.

Cybersecurity aids in protecting computer networks, computers, and other electronic assets against data breaches, cyber-attacks, and/or unauthorised access. Cybersecurity uses a variety of approaches borrowed from various disciplines such as computer science, criminology and cryptology to ensure that an organisation’s data and properties are protected from hackers, cybercriminals and other malicious agents.

Cyber-attacks on a chemical plant may take two forms – it could be an intelligence activity to gain access to intellectual property, such as formulations or process flow diagrams, or an attack on the ICS, which controls vital plant functions, and a failure caused by a well-planned attack could result in physical harm. Chemical industries deal in the storage and processing of operationally hazardous chemicals like chlorine, hydrogen chloride, nitric acid, ammonia, vinyl chloride and methyl isocyanate, among various other harmful grade chemicals. Not to mention, having a strong cybersecurity framework is a necessity that cannot be overlooked to maintain safety at the workplace.

Predictive analytics

Predictive analytics is increasingly seen as the panacea to address chemical industries’ pain points. This AI-powered technique uses historical and real-time data to predict critical future outcomes, reduce risks, improve operations, cut costs and increase revenue. Chemical manufacturers can increase the operating time of critical assets by using predictive analytics to find ways to anticipate their failure.

Predictive maintenance analyses the historical performance data and offers real-time data of production units and their machinery to forecast when equipment is likely to fail, limits the time it is out of service and identifies the root cause of the problem. Yield, energy and throughput analytics can be used to ensure that the individual production units are as efficient as possible when they are operating.

The path ahead

As we advance, automation and digitisation technologies like IIoTs and analytics are going to play a huge role in the chemical industry. As with any major initiative, digital transformation in the chemical industry is likely to be challenging. But with the help of the right framework and vision, chemical companies can increase their manufacturing process efficiency and can help them negate human errors. Thus, avoiding any mishap in the chemical industry.
High-end PC for mobile machinery

B&R Industrial Automation recently added a high-end PC to its mobile automation portfolio, IP69K PC. The new PC offers significantly more processing power & memory, giving plenty of resources to implement autonomous functions for agricultural & construction vehicles or self-driving transport systems. It is specially designed to perform in harsh environments. The housing temperature can be between -40°C and +85°C. The PC is also highly resistant to shock and vibration. Inside the mobile PC’s IP69K housing is an Intel Core i7 processor. Also, it has 16 GB RAM and 480 GB flash memory, making it ideal for applications that are computationally intensive or involve larger volumes of data. The increased computing power is needed for tasks such as accurate path planning in autonomous agricultural vehicles. More efficient, more precise vehicles deliver increased yield. The PC’s high performance makes it optimally suited for smart machines that communicate with each other, process data and send it to the cloud. Tractors and implements can optimise harvesting efficiency, for example, by exchanging information such as speed and load capacity.

Single-pair Ethernet cables

Lapp recently introduced the new ETHERLINE® T1 Y Flex 1x2x22/7 AWG. It is a UL-certified two-core data cable for high-speed information exchange that maintains the same high data rates while significantly reducing the set-up required. Thanks to its small bending radius & small outer diameter, it is exceptionally lightweight and easy to install and is indispensable for connection at the field level. The new ETHERLINE® T1 Y Flex 1x2x22/7 AWG opens up a host of future-proof possible applications in automation technology. The company has defined a wide range of applications:

- Flexible use in dry and damp rooms, as well as for medium mechanical stress
- For structured cabling in compliance with DIN EN 50173 and ISO/IEC 11801
- For single-pair Ethernet applications - 1000Base-T1 in compliance with IEEE 802.3bp and 100Base-T1 in compliance with IEEE 802.3bw

The two cables that will be available soon are the ETHERLINE® T1 FD P which is a shielded 26AWG cable for Gigabit Ethernet & use in cable chains and the ETHERLINE® T1 P FLEX 18AWG for 10 Mbit/s & distances of 1000 m.

Industrial gear units

Nord Drivesystems recently expanded the MAXXDRIVE® industrial gear units that are used when high output torques & powers are required. The new MAXXDRIVE® XT industrial gear units with their heavily ribbed housings are ideally suited for sufficient heat dissipation to allow for ultimate thermal limit powers. MAXXDRIVE® XT series output torques range between 15 and 75 kNm with speed ratios of 6.3 to 22.4. MAXXDRIVE® XT industrial gear units are available in seven sizes for powers from 50 to 1500 kW. The company also offers innovative predictive maintenance concepts specially designed for MAXXDRIVE® industrial gear units. The NORD frequency inverter is an essential component here. The status data available in the inverter can be communicated to a higher-level control or directly to a safe cloud. The inverter can also directly record external sensor data for vibration monitoring or measuring the gear unit’s oil sump temperature. Changes to the system condition can be detected at an early stage (condition monitoring) and predictive maintenance can be scheduled in good time.

HMI operator workstation

Pepperl+Fuchs recently presented the new modular VisuNet FLX HMI operator workstation, which is part of a comprehensive range of operation & monitoring systems for ATEX/IECEx Zone 2/22 and Division 2 (global certifications pending) and non-hazardous areas. This product suite provides a range of solutions that allows the automation specialist to offer total flexibility in the field. The new platform is tailored to the needs of the petrochemical, chemical, and pharmaceutical industries. The fully modular design enables the configuration of HMI solutions to maximise functionality. The devices in the new VisuNet FLX series can be ordered in three basic configurations, depending on the user specification.

1. HMI system: Complete HMI system (various display options in Full HD) combined with a thin-client, PC or direct monitor unit, including stainless steel housing in a hygienic design. Suitable for standalone installation, such as on a pedestal or support arm.

2. Panel PC: Display (various display sizes in Full HD) combined with a thin-client, PC or direct monitor unit for panel mounting.

3. Box PC: Standalone PC or thin client for direct installation in a switch cabinet.
Intelligent edge automation platform

Red Lion Controls recently introduced an intelligent edge automation platform, FlexEdge™, which offers processing companies comprehensive functions for decentralised data processing at the edge of the network. It combines classic SCADA tasks with simultaneous flexible networking for immediate data transport.

Regardless of the manufacturer, the edge automation models not only offer interfaces and drivers for over 300 industrial controllers and data sources but also for higher-level IT enterprise systems. Networking is thereby wired, wireless via Wi-Fi or LTE, future-proof prepared for 5G.

Solve complex tasks more easily

By combining all data-relevant tasks in one automation device, data management is unified. Different platforms are controlled centrally as a clear database in one. Higher-level IT systems, which are connected, e.g. via OPC UA protocol or MQTT cloud connectors, receive a clearly defined data image, which are already pre-processed, relevant production key figures instead of bloated and unorganised data graves.

FlexEdge™ as a modular and scalable gateway family provides a uniform and consistent basis for communication and networking, control functionality, e.g. via IEC61131, visualisation, data acquisition, analysis, remote access and IoT connectivity. At the heart of edge automation with FlexEdge™ is Crimson® integrated programming software, which neutralises the increased complexity in automation.

The new edge automation software, in combination with the software Crimson®, represents a perfect unit of hardware and software which are optimally matched to each other to simplify and reduce complex tasks. The FlexEdge™ automation series are built-in devices that eliminate the need for costly operating system maintenance, including constant security patches. The models are encapsulated and securely separate their machine network from the outside world. The issues of data security and access protection are another key point in the implementation of Industry 4.0. It is here that encapsulated embedded edge automation devices offer an enormous advantage over PC-based systems, especially where the IIoT is moved right into the machine controller. A machine manufacturer cannot do without this additional security under any circumstances.

Future viability and sustainability

The company has a special focus on the flexibility and forward-looking functionality of its FlexEdge™ platform. The platform is designed to be completely modular and maximally flexible. This means that an edge automation platform which is already available today can still be used in 20 years and correspond to the life cycle of a machine.

Essential interfaces, e.g. the mobile radio connection, are implemented via so-called sleds, i.e. plug-in units. If the machine is delivered with 4G technology today, the customer can replace the 4G sled with a 5G sledge in two years’ time without having to replace the entire device. A major advantage is the direct replacement on-site the existing application is not disturbed or taken out of operation.

FlexEdge™ is thus a hardware and software solution that creates added value from the data of the user’s machine. In addition, interfaces for all future innovations are provided to realise Industry 4.0 according to current standards at any time.

Whether integrating modern machines or existing plants in the factory, future technology standards must not be neglected in any case. The new platform speaks both OPC UA & MQTT and is prepared for the next industrial Ethernet generation, TSN. It is additionally available with extended network functions as well as with extended control features, e.g. protocol conversion, virtual HMI, web server with Bootstrap, JavaScript and CSS, data security and event logging as well as cloud connection with pre-configured provider.

A variety of wireless as well as wired communication options are already available in the portfolio. These include multiple isolated serial ports, Ethernet, Wi-Fi and cellular I/O modules for direct sensor connection and PID modules.

Not only the hardware but also the associated Crimson software is modular. On the one hand, this is intended to enable user-friendly point & click applications and, on the other, customer-specific modifications or extensions in the future as well. Especially with regards to brownfield systems, this is a central aspect. Hardly any user manages to modernise all machines at the same time. It simply takes a certain amount of time to make a plant IoT-ready with Crimson® and the user can get there step by step.
Industrial shock absorbers

A shock absorber or damper is a mechanical or hydraulic device designed to absorb and damp shock impulses. It does this by converting the kinetic energy of the shock into another form of energy (typically heat), which is then dissipated. Most shock absorbers are a form of dashpot (a damper that resists motion via viscous friction).

The use of industrial shock absorbers significantly reduces shock and vibration to machinery. This eliminates machinery damage, minimizes downtime and maintenance costs while increasing machine life. Machines can be operated at higher speeds because industrial shock absorbers control or gently stop moving objects. Therefore, production rates can be increased. Harmful side-effects of motion, such as noise, vibration and damaging impacts, are moderated or eliminated, so the quality of production is improved. Therefore, tolerances and fits are easier to maintain.

Industrial shock absorbers protect machinery and equipment operators by offering predictable, reliable, and controlled deceleration. They can also be designed to meet specified safety standards when required. Machines become more valuable because of increased productivity, longer life, lower maintenance costs and safer operation.

One can use industrial shock absorbers for linear slides, swivel units, turn-tables, portable, and commercial appliances, factory floor machinery, automated machinery and equipment, tooling machines, machining centres Z-axes, impact panels, handling modules, robots & gantries, medical tables and many more.

PowerStop 2.0 series

The Zimmer Group’s PowerStop industrial shock absorber family has already made a name for itself on the market thanks to its high energy absorption even in small installation spaces. We have taken it to the next level by adding an extensive range of products and optimisations; we call it ‘PowerStop 2.0’.

The series is available in four variants. ‘Mini Energy’, featuring the small M4 to M6 installation sizes. The ‘Standard Energy’, which reflects the cost-efficient option at an established level of competition and available at an attractive price. ‘High energy’, represents the gold standard, featuring the highest energy absorption on the market. The ‘Adjustable Energy’ covers the full velocity range from 0.1 - 5 m/s. Here, an extensive range of impact velocities can be quickly & variably adjusted to ensure optimal dampening for different amounts of mass or energy.

Currently, the series is available in the M4-36 thread sizes and will later be expanded by adding M45 + M64 threads. Apart from the clamping flange can be screwed on from above, another new feature is a clamping flange that can be screwed on in the direction of the industrial shock absorber. It is very flat, which makes it easier to attach using commercially available screws, especially at large thread diameters.

Four new thread pitches have been added to the series as additional features, & an innovative biologically-based oil with H1 food-grade certification is now being used with all dampers.

Product benefits at a glance

• Superior spiral groove technology
• User-configurable series with significant additions accessories
• Integrated fixed stop, especially with Adjustable Energy, an external fixed stop is not necessary. Force in the end position max. is specified in the catalogue.
• Protection against liquids or dust and chips as standard option. Ideal pricing on customer requirements possible. Flexibility to adapt the damper to the surrounding condition. Four different protection versions (adapted to the environment).
• Four new (thread) sizes. Adapted long-stroke versions. Same energy consumption as normal stroke -> smoother damping. Expansion to sizes M14 and M16.
• The highest energy absorption at the lowest space requirement is achieved thanks to optimal utilisation in every piston position.
• New configurable Adjustable Energy series + fixed stop.
• The fine adjustment of the damper ensures optimum damping throughout the stroke and up to the fixed stop
• Biological oil is used. High environmental sustainability, due to biodegradability.

Visit: http://www.zimmer-group.com
## Highlights – Aug-Sep 2021

### AUTOMOTIVE

The automotive industry has swum from shrinking economic activity, growing competition and slowdown. What’s more, digitisation, swelling automation and new business models have revolutionised other industries, including automotive. The next issue discusses the disruptive trends that will transform the automotive industry and what lies ahead for the sector.

### ARTIFICIAL INTELLIGENCE

The competences of Artificial Intelligence are far beyond human capacity. It assures to redefine the manufacturing industry and the increasing digital transformation happening within manufacturing is bringing the prospective of AI into light. The following issue highlights how manufacturing is a hotbed of AI innovation.

### AR/VR

AR/VR is currently making positive disruption for an enormous number of operational processes in manufacturing. They have gone on to enhance the jobs of workers in the industry. The next issue throws light on the upcoming industrial applications in AR/VR.

### COMPANY INDEX

<table>
<thead>
<tr>
<th>Name</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altair Green Propulsion Labs</td>
<td>30</td>
</tr>
<tr>
<td>Aspen Technology</td>
<td>22</td>
</tr>
<tr>
<td>Automation Industry Association (AIA)</td>
<td>09</td>
</tr>
<tr>
<td>BAR Industrial Automation</td>
<td>47</td>
</tr>
<tr>
<td>Buddha Institute of Technology</td>
<td>16</td>
</tr>
<tr>
<td>Capgemini</td>
<td>06</td>
</tr>
<tr>
<td>Clean Energy for Africa</td>
<td>32</td>
</tr>
<tr>
<td>Confederation of Indian Industry (CI)</td>
<td>08</td>
</tr>
<tr>
<td>Contrainx Automation</td>
<td>15</td>
</tr>
<tr>
<td>Emerson</td>
<td>41</td>
</tr>
<tr>
<td>Exalta India</td>
<td>30</td>
</tr>
<tr>
<td>Hero Lectro E cycles</td>
<td>29</td>
</tr>
<tr>
<td>Hischer India</td>
<td>11</td>
</tr>
<tr>
<td>IMES</td>
<td>29</td>
</tr>
<tr>
<td>f&amp;m electronic India</td>
<td>12</td>
</tr>
<tr>
<td>Imaginarium (Rapid)</td>
<td>35</td>
</tr>
<tr>
<td>Industrial Vision Systems (IVS)</td>
<td>07</td>
</tr>
<tr>
<td>Innovox Sensors</td>
<td>10</td>
</tr>
<tr>
<td>International Federation of Robotics (IFR)</td>
<td>13</td>
</tr>
<tr>
<td>JiskaTech</td>
<td>47</td>
</tr>
<tr>
<td>Kirloskar Brothers Limited (KBL)</td>
<td>09</td>
</tr>
<tr>
<td>Lapp India</td>
<td>47</td>
</tr>
<tr>
<td>Lincode</td>
<td>38</td>
</tr>
<tr>
<td>Logistics</td>
<td>09</td>
</tr>
<tr>
<td>Mettler Toledo India</td>
<td>21</td>
</tr>
<tr>
<td>National Productivity Council</td>
<td>16</td>
</tr>
<tr>
<td>Nippon Research Institute</td>
<td>29</td>
</tr>
<tr>
<td>Nord Drivesystems</td>
<td>47</td>
</tr>
<tr>
<td>Pepperl+Fuchs</td>
<td>47</td>
</tr>
<tr>
<td>PHD Chamber of Commerce and Industry</td>
<td>08</td>
</tr>
<tr>
<td>Red Lion Controls</td>
<td>01</td>
</tr>
<tr>
<td>Roland Berger</td>
<td>48</td>
</tr>
<tr>
<td>Sumitomo Udyog Mission</td>
<td>28</td>
</tr>
<tr>
<td>SEW Eurodrive</td>
<td>31</td>
</tr>
<tr>
<td>Sharda Group of Institutions (Hindustan)</td>
<td>16</td>
</tr>
<tr>
<td>College of Science &amp; Technology</td>
<td>16</td>
</tr>
<tr>
<td>Siemens</td>
<td>08</td>
</tr>
<tr>
<td>Spark Minda Group Companies</td>
<td>26</td>
</tr>
<tr>
<td>Tata Chemicals</td>
<td>44</td>
</tr>
<tr>
<td>Tata Technologies</td>
<td>09</td>
</tr>
<tr>
<td>VEGA India Level &amp; Pressure Measurement</td>
<td>25</td>
</tr>
<tr>
<td>Zimmer Group</td>
<td>19</td>
</tr>
</tbody>
</table>

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In today’s Digital world where industries are creating, transferring and analysing more data than ever, there’s greater need for seamless and reliable network connectivity. Driving Industry 4.0 are technologies like IoT, Cloud Computing, Big Data and Artificial Intelligence which require multiple devices to be connected and intelligent communication in harsh industrial environments.

Data is the lifeblood of Industry 4.0, hence fast and reliable data transmission is important to make critical data driven decisions.

LAPP, a leader in cable and connection technology offers comprehensive Industrial Communication solutions which are customised for Factory, Process and Building Automation. Our extensive portfolio includes data lines, connectors, patch cords and Ethernet & Fieldbus switches. We offer everything today’s smart network needs such as, complete cabling and connector systems, comprehensive connectivity between the sensor/actuator and control levels to an ERP system - all under one roof.