

# Technology Watch at CES **FACTORY OF THE FUTURE**

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## **Abstract:**

*We are at the dawn of a period of major transformation: the 4th Industrial Revolution. Thanks to digitalization, industries become fully automated and interconnected cyber physical worlds. Artificial intelligence, robotics, IoT and 3D printing are at the core of this transformation.*

*Today, start-ups and companies are developing new industrial solutions that are shaping the industry of tomorrow. Therefore, the CES was a perfect opportunity to observe the different trends of the industrial sector, as the show becomes more and more B2B. In this context, my goal was to discern the trends of the industrial sector that will build this industry of the future, in view of the different solutions presented throughout the show. So I went through hundreds of stands looking for innovative solutions for the industry to establish the trends at the CES Las Vegas.*

*The technologies exhibited at CES follow the trends of this industry of the future. Robotics, 3D printers and AI technologies automate and connect the entire industry, from production to delivery. The CES was also full of solutions to protect workers and industrial sites. Security was therefore another central theme for the industry of the future. Finally the 5G made its start at CES, which gives hope for a speed of connection radically increased. That is a necessity to build the industry of the future. In this report, you will find the start-ups that exhibited these innovations.*

## Introduction

The purpose of my mission was to highlight the trends of the industry sector at the CES 2018-Las Vegas

### Why carry a watch on the industry of the future out on a B2C show?

The CES is a B2C show, addressed to consumers. One can therefore wonder why carry out a monitoring mission on the industry of the future. But the CES of Las Vegas may be a B2C show. it is a place to make known to professionals. Indeed, the CES is full of exhibitors, investors, industry and media. Moreover, most of the discussions are between professionals. The companies that build the industry of the future are in the best place to find new customers. Companies that offer industrial solutions to find B2B customers are more and more numerous. Besides, some exhibitors were criticizing that. The strong presence of these numerous industrial solutions alone justifies a watch on the industrial sector.

### What is the industry of the future?

The digital revolution is transforming the industry in depth and companies are now facing a complete and profound change. Factories, workers and industrial stakes are changing. This digital revolution is building the industry of the future, an industry with highly automated and interconnected factories, concerned with the well-being of its employees and the environment.

Today, this industry is given several names, smart industry (smart factory for factories), industry 4.0 (factories 4.0). Industry 4.0 refers to the fourth industrial revolution we are experiencing. After the arrival of the computer and automation, the industry becomes an interconnected and automated physical cyber system.

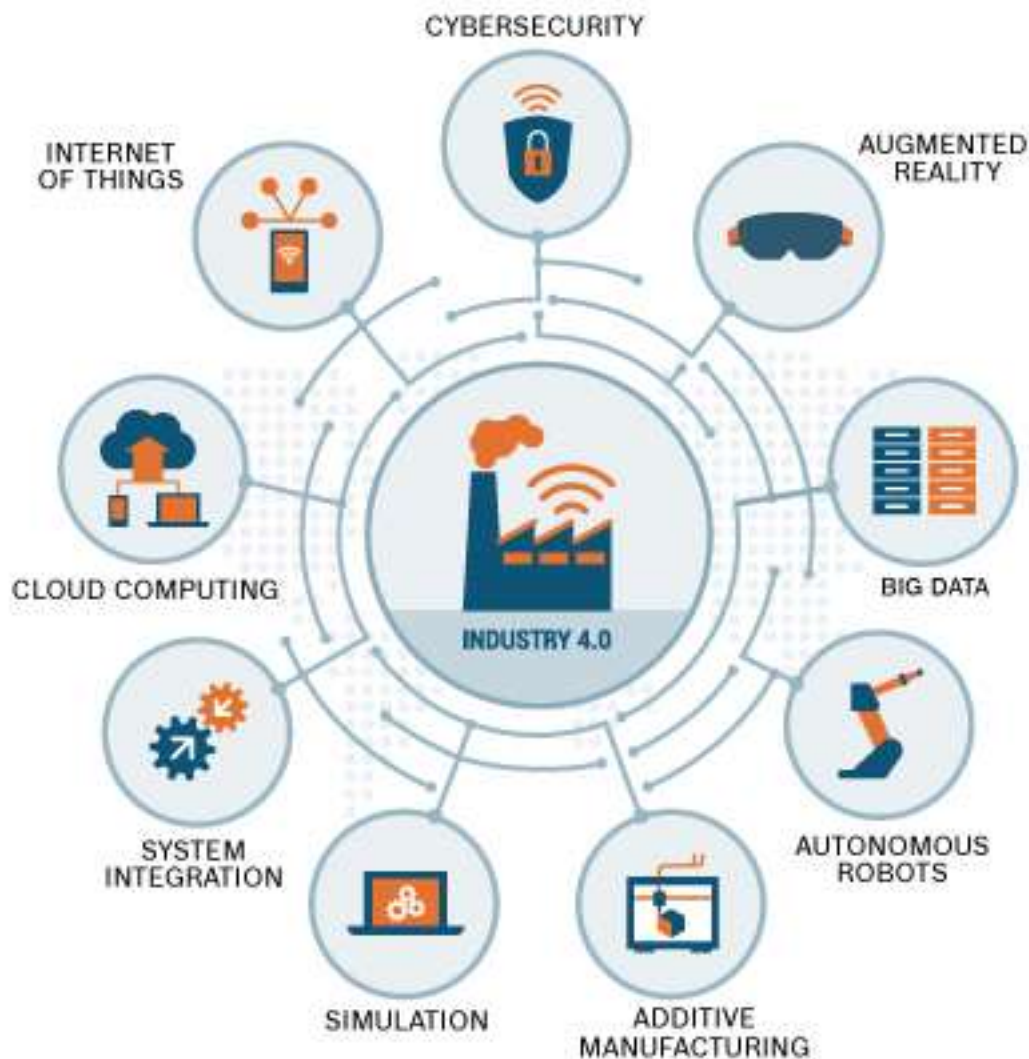


Source : [https://fr.wikipedia.org/wiki/Industrie\\_4.0](https://fr.wikipedia.org/wiki/Industrie_4.0)

### What are the components of this industry of the future?

The components of this industry of the future are multiple: IoT, autonomous robots, AR & VR, 3D printing, etc. They are the main actors of this industrial revolution and play a complementary role, IoT for interconnection, augmented reality for industrial simulations and predictive maintenance, cybersecurity to adapt to new threats, 3D printing for a faster and more personalized production.

### The components of industry 4.0



Source : <http://blog.boschindia.com>

### What are the main trends at CES 2018?

Industry of the future - Technology watch at CES 2018  
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CES's major trends for the industry of the future are linked to the fourth industrial revolution. Indeed, the entire value chain of the industry is being automatized and interconnected. Human was also one of the trends of the CES. Some companies offered solutions to improve workers safety and to promote the harmony between Humans and machines.

- The transformation of the production

The production chain is being totally transformed by the current industrial revolution and the advent of flexible automation solutions. Therefore, at the CES, 3D printing and robotics hold a predominant place.

- Additive manufacturing automates production

At the CES 2018, the manufacturing of the future lies, first and foremost, on 3D printing. Although the sector is struggling to grow - the turnover of market leaders such as Stratasys, 3D systems or Ultimaker progress little - 3D printing companies had come in number at the 2018 show. Indeed, more than 50 companies were presenting their new generation printers, the 3D printing Marketplace was exhibiting most of them. Besides, this marketplace was the most represented one in the show and probably the one most targeting B2B.

The first observation is that 3D printing for the consumer market, which had been a theme of attraction of the previous CES, has declined in favour of industrial 3D printing, well represented this year. Companies become aware of the industrial challenge and therefore they have developed offers for individuals and professionals, mostly industrial. This area will interest most manufacturers.

In this new edition of CES, there were no breakthrough innovations but concrete improvements. Indeed, if the printers do not transform in depth, they are more and more efficient and multitasking. So the innovations affect more the uses of the machine than the machine itself. The CES highlighted these uses / trends:

- 3D printers are getting faster: for example the **NXV** exceeds by far the speed of traditional machines. It is able to make objects with a speed of 1 cm / min.
- Printers are also safer: some printers support high temperatures such as **Asiga** printer (supports 200 ° C) (explanation)
- New production methods: plastic extrusion fusion remains the preferred medium for 3D printing but new uses are developing: stereolithography, metal printing, engraving.
- More and more diversified materials are appearing: metal printing keeps growing in industrial circles. For example, MarkForged showed its Metal X printers and others that are suitable for carbon fiber for the aerospace industry. Ceramic and glass printing are also developing. For example, **Kwambio presented Ceramo One** which uses ceramic.

Here are some of the 3D printers, exhibited in Las Vegas this year.



The **XCELL 3D** printer developed by the Italian company DWS uses a 3D stereolithographic printing system. **DWS** integrates a washing and drying system in this 3D printer. Thus, there is no need for any intervention while submitting a file. After printing, the build plate elevates and moves objects into a second chamber for washing. In the next step, the plate dips the objects into a third chamber where they are cured to remove any residue.



The **Rize One** is a 3D printer developed by **Rize**, a french start-up incubated at Dassault System. It avoids having to delete object supports after printing. It uses its own particular resin, the Rizium One. It has a build size of 300MM X 200MM X 150MM. The printer has been on the market since June 2017. It is intended for prototyping, manufacturing and end use production parts.

**Ethereal Machine** is an indian company that won the best price of innovation for 3D printing category thanks to their Halo 3D printer. The start-up based in Bangalore has made noise with its **Halo 5D printer**, a printer capable of printing on five axes and thus allows doing complex printing helping to identify and get answers to industrial issues. The printer is already on the market and costs up to 25000 €.



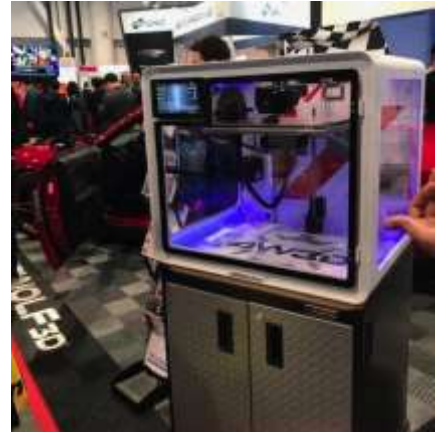
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**Kodak** introduced its new ecosystem composed of a 3D printer, the Kodak Portrait, software and printing materials. The Kodak portrait 3D Printer is built for productivity. He has a large build volume of 200x200x 250 mm, two extruders, an



end-of-filament sensor, and a nozzle-wiping mechanism to prevent the deterioration of product colour.

The US Company **Airwolf** was presenting **EVO**, a 3D printer for manufacturers. The main assets are its large size, its multi-material uses and its resistance to high temperatures. According to its leaders, it is faster, more powerful and more accurate than most 3D printers.



The Canadian company **RAISE 3D** exhibited its 3D printers, the **N2** and **N2 +** respectively sold at € 3,500 and € 4,500. They are also multi materials as PLA, ABS, PC, PETG, and HIPS. They are mainly intended for prototypes designers. They also have two extruders.

**Artec 3D** presented its 3D printers and 3D scanner. The scanner is promising because in two minutes the scan is done and the object is designed in 3D before being sent in print. It is therefore a very fast printing. Artec 3D also presented a large format scanner that scanned the visitors themselves.



The company **Luzbot** presented its technology **Mini**, a printer rather intended for the consumers but it can interest the manufacturers it prints very quickly. He took advantage of the 4 days of the show to continue producing new printers.





The company **Nexa3D** makes ultra-fast stereolithography 3D printers. He was presenting **NXV**, a professional 3D printer, which is capable of printing 30-micron XY resolutions. The NXV is the fastest - he offers a speed of 1 cm / min - and most accurate 3D printer in its category. It is equipped with cognitive software and integrated sensors that together optimize manufacturing performance, provide detailed diagnostics and offer continuous monitoring. The printer is perfect for prototype production.



Other 3D printers were present at CES 2018 such as **Epilog Laser**, **XYZ printing** or **Colid3o**. For sure, 3D printing companies was plentiful.

- Robotics associated with AI and IoT are creating intelligent and interconnected machines.

Robots were once again very present at this new edition of CES 2018, mainly with educational robots such as **Cozmo** or **Luka** and robots for airports and shops such as the Russian robot

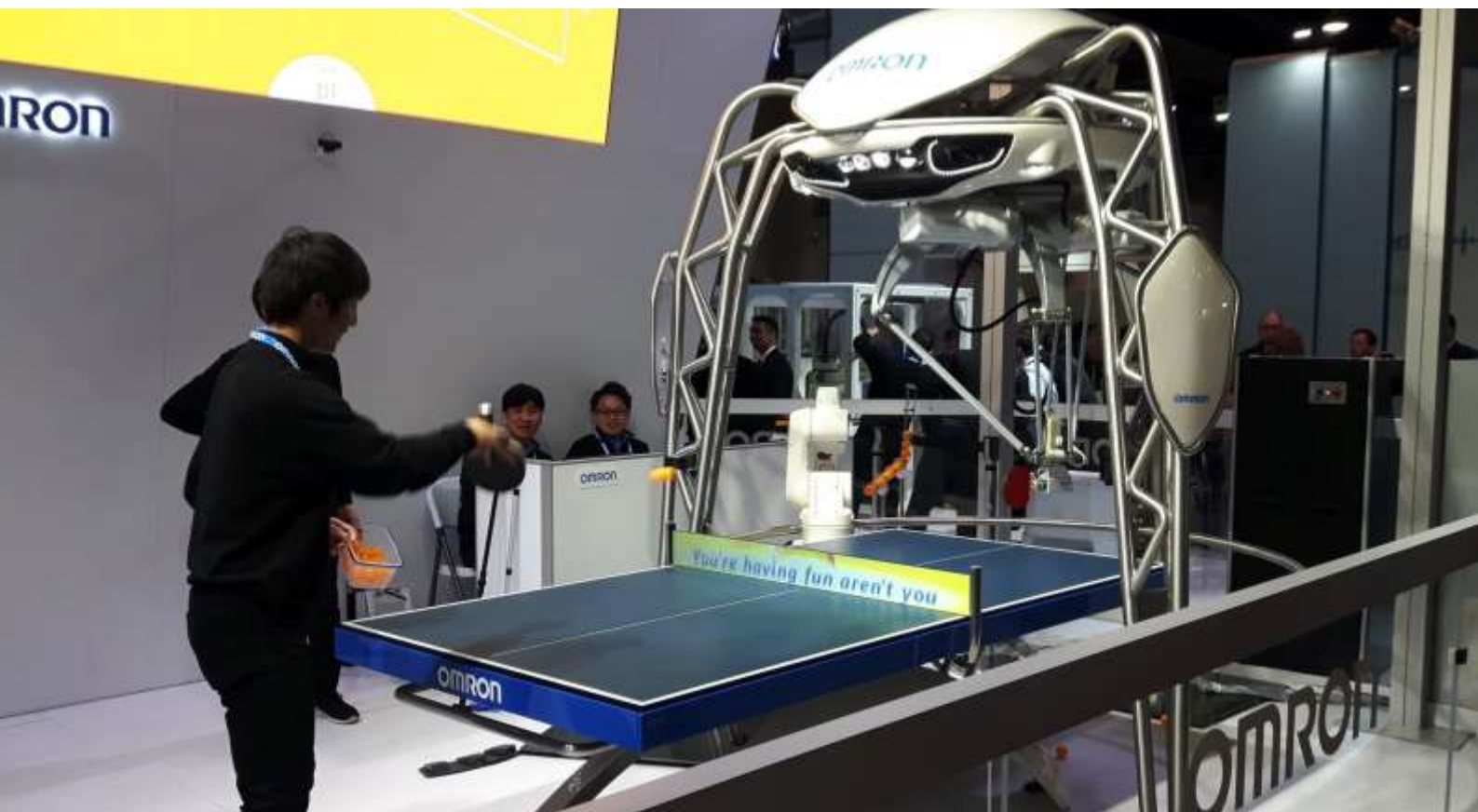


**Promobot.** But despite the development of AI and IoT, it is difficult to see breakthrough innovations for most of the robots presented.

However, very promising industrial robots have clearly stood out at the show, making it possible to imagine the factory of tomorrow and to observe advances in automation, AI and sensing. These robots are composed of several components - AI, robotics, AR / VR - that are associated to create automated, intelligent and interconnected machines.

## OMRON

The Japanese company Omron, which develops robotics and AI solutions, was undoubtedly the star of CES 2018 with his Ping-Pong robot Forpheus. Rather than playing with a human, Forpheus analyses your skill level and adjusts his level. It is more than an opponent. It is a coach. Thanks to



its three cameras, he can evaluate his players with his AI controller. He can predict trajectories based on the movements of the other player. It can predict smashes for example. Thus, you can imagine its analysis speed. An association between artificial intelligence and IoT enables this.

In addition to Forpheus, Omron presented its industrial technologies by presenting a small production line with two robotic arms (image below), automated and interconnected by using the AI-IIoT combination. The robotic arms detected the pucks that moved on the treadmill, caught

them and moved them from one carpet to another without dropping a single one. The machines analysed very quickly the pucks and as soon as a one was about to fall, they stopped. Moreover, when a human added pucks or put his arm, the robotic arms detected him and stopped in case of danger.



Omron was one of the big stars of this CES and attracted many visitors who came in droves to play against Forpheus and attend the presentations. Yet the company offers above all industrial B2B solutions, difficult to attract on its stand with the only exhibition of industrial robots. But Omron has managed a coup by attracting consumers through Forpheus, bringing with them the media, industry and investors. Therefore, the booth attracted both consumers and professionals. Understandable view such technologies but an example to follow anyway.

## DOBOT



**Dobot** is a Chinese company that was presenting its articulated arm **Dobot Magician**, a robotic arm that gives a new trend: the fusion of robotics and 3D printing. Indeed, not only this little robot can write, as you may see on the picture, but he can also 3D print, laser engrave, paint and hold objects. Dobot is an example of this trend of multitasking robots. Dobot develops solutions for manufacturers but also consumers for education in particular. Besides, the Dobot Magician presented is more for an educational use but the company develops many industrial solutions such as 3D printers. And where the Magician is more for an education environment, the DOBOT M1 and DOBOT MOOZ are Shenzhen Yuejiang Technology's answers for industrial customers. The Dobot M1 is sold for \$999. In addition to the basic 3D printing, pick & place, laser engraving and writing functions, the M1 can be configured to solder components, and even 3D print using SLA. An expansion of the M1, the MOOZ model comes with a sturdier metal frame and a number of under-the-hood additions to make industrial works more precise.

- Logistic transformation



It was said that the entire value chain of the industry is being transformed. Therefore, logistics also becomes automated, interconnected and intelligent. This trend was felt at the show with the presentation of autonomous vehicles and intelligent robots that suggest a rapprochement between manufacturers and consumers.



**Hardis Group** is developing **Eyesee**, a drone designed to automate, secure and accelerate inventory and inventory control operations in warehouses, and in addition removes the cost of renting nacelles. Eyesee is therefore the perfect example of this automation of logistics.

For the first time trucks were exposed at CES. The Chinese start-up **Tusimple** presented its autonomous truck equipped with multiple cameras, many sensors and technology NVIDIA Driver.



We imagine that trucks can be interconnected to fully automate the entire value chain from production to delivery.



**Unsupervised**, a start-up incubated at **Dassault System**, presented **Aida**, an autonomous, last-mile, secure delivery vehicle. If this robot is more for e-commerce, the start-up also develops a robot for the industry.

**Honda** introduced several autonomous freight robots that can be used in warehouses and factories, including the **3E-D18** four-wheel drive and can service for different purposes such as heavy cargo transport. The **3E-C18** is him, a small robot that can move heavy loads and carry them.



The **GoCart** autonomous robot was presented by the Korean company **Yujin Robot**. It can carry loads and move parts especially in an industrial setting.

- Industrial solutions to improve security
  - Tools for workers safety



The German company **Proglove** is developing **Mark** a pair of gloves that secures workers on the production line. Indeed, workers must very often take off their gloves to scan.



Likewise, **Thread in Motion** is developing **Smartglove**, a pair of safety gloves with scanner on the back of the glove to secure and facilitate the work of employees.

**Bionear** is a headset, developed by the French company **Cotral Sécurité**, for workers communicating in noisy environments such as sawmills. Thanks to a printer printed in 3D based on the shape of your ear, no air passes and allows total sound.



The company **Numii** presented **AIO**, a connected

object to detect the musculoskeletal disorders of the workers who practice difficult trades, within chains of production for example. generating large-scale data on the postures and movements of industrial workers.



The French company **Evone** exhibited its GPS-enabled smart shoes that detects falls. It tackles the market for seniors but also industries with connected safety shoes. The shoe will include GSM for communicating in at least 120 countries, a GPS or LoRA antenna for locating as well as a gyroscope and accelerometer for movement sensing



**Realwear** is a company that has a connected safety helmet designed for industrial workers who need to be at home when they talk to consultants. It consists of a head mounted tablet and a voice recognition. The software supports 10 languages.

- The safety of industrial sites
  - Autonomous drones to monitor sensitive industries



The **Falcon 8+** drone is developed by **Intel** to inspect industrial sites by providing a stable flight. The drone provides real-time different data by 3D reconstruction with millimetre accuracy. Its goal is to detect industrial flaws.



The **French Azur** drone showed **skeyetech**, a 100% self-contained drone that can monitor sites with a 360 camera. The drone has a battery life of

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only 30 minutes but will recharge itself, so it is operational 24 hours a day



**Fotem** develops a drone that sends nets and recovers drones that venture on its territory day and night, in rainy weather or good weather. A product to secure sensitive industrial sites from intrusions.

- Solutions for simulation and predictive maintenance

**Avnet** presented its various IoT solutions, particularly for the industrial sector. He proposes to create a cyber physical system within industries. To do this, he implements IoT solutions, collects data on the cloud and analyses it to propose the right decisions.



The French company **Iteca** presented its simulation solution with its IA **SmartUpp** platform, intended for industry. Using the sensors connected to the 3D interface, industries will be able to simulate all their processes.



The start-up **Meshroom VR** from Bordeaux presented a visualization tool in virtual reality that allows designers and designers to directly validate the design of their 3D objects such as the shape of the product in design.





The Norman start-up **Siatech** presented his **ComHand** connected bracelet allowing to pilot various industrial applications by simple gestures, at a distance, thus reassuring the workers and limiting the errors.



The French start-up **Fieldbox.ai** proposes industrial solutions of AI and proposes, thanks to the data of an industry to carry out predictive maintenance, by looking for the precursors signs of a failure

**Wavely** offers predictive maintenance solutions for the industry. Company sensors monitor industrial equipment 24/7. Thanks to the AI, they detect the abnormal noises characteristic of a fault and trigger an alert by email or SMS automatically.



- Sensors are the key points of the industry 4.0

Smart sensors are main points of the smart factory. They allow machines that depend on it (machines, robots, etc.) to configure, control, manage and optimize themselves. Thus the accuracy and reliability of sensor data are more than ever essential.



**Bosch** had a large booth to showcase its innovations

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for the smart city, smart home and smart factory. In particular, he presented live equipment analysis solutions that combine sensors and IoT, thus allowing the machine status to be identified. Bosch can install it on any machine even old as on that present at CES.



**Nidec**, the leading engine manufacturer, introduced its Torque Sensors, new, highly accurate sensors for robotics. Two sensors presented could calculate the force on 3 axes and 6 axes.

We can also mention, **Yes It Is**, a French company that introduced **Tag Sensor**, an environmental data sensor (temperature, humidity, pressure, shocks and rollover) that will analyse the environment of the industrial sector.

- 5G is an accelerator to the industry is the future



5G was also very present at CES 2018. For example, the South Korean telephone operator, KT, showed how the Pyeongchang Olympics are visible thanks to 5G. Or 5G is one of the major assets of the interconnection of cities, homes and industries. Indeed, the 5G will be 20 times faster than the current 4G and allow objects to communicate with each other, and thus facilitate the transition to industry 4.0. For example, when a car will brake, all vehicles behind will know and will be able to brake even before their driver realizes it. Similarly, in the industry, machines can communicate information in real time to produce smarter.

Despite these hopes, the 5G did not dominate the show but will probably be one of the stars of CES 2019 and will be available to consumers until 2020.

- “The harmony between Humans and machines”

Finally, one of the major challenges of the industry of the future is the human. Indeed, according to a report from the World Economic Forum, organizer of the Davos forum, the fourth industrial revolution will result in the loss of more than 5 million jobs if no action is taken to manage this transition.

At the show, some robotics and AI companies were trying to reassure consumers and professionals about the place they will have within the company with slogans such as "The harmony between Humans and machines". They say that machines will not replace humans, but work and live in harmony with them. Omron's ping-pong robot is an example since the robot and its partner learn together.

But despite these slogans, the potential harmony between the human and the machine remains unclear and jobs within Industry 4.0 are highly threatened.

## Conclusion

The CES 2018 has revealed a part of what the industry of the future will be and has confirmed the trends of the industrial sector. Industry is going through a radical transformation and many technologies exhibited at CES 2018 have showed it. From production to delivery, innovative products were offered to industries to improve automation and interconnectivity. Solutions that participate in improving workers and industrial sites safety were also presented. Thus the future of industry will also be a better and safer place to work. Moreover, some exhibitors have showed solutions to improve simulation and anticipate failures in industries. Finally such a transformation involves a better connectivity. At CES, 5G and sensors have responded to this need.

The innovations exhibited for the sector of industry let us imagine what the industry will be. We can believe for example that when a customer will buy a car, he could design it on the Internet. The customised car will be sent to 3D printers, which will make car parts. Robots will rapidly assemble the parts and colour the car according to custom. At the same time, industry will improve its productivity and organisation. Thanks to IoT, machines could be interconnected and work in harmony with humans. Thanks to virtual reality, industries could simulate industrial environment and implement predictive maintenance for a better use of their resources.