انقلاب صنعتی چهارم و صنعت خودروسازی

علیرضا حاجی علی محمدی

فروردین ۱۴۰۰

انقلاب های صنعتی

مروری بر انقلاب های صنعتی

- ***انقلاب صنعتی اول:قرن هجدهم- اختراع موتور بخار***
- ***انقلاب صنعتی دوم: قرن نوزدهم-اختراع برق و شروع بهره برداری از نفت و گاز***
- ***انقلاب صنعتی سوم: قرن بیستم-رایانه، PLC و ربات***
- ***انقلاب صنعتی چهارم: کاربرد وسیع اینترنت و هوشمندسازی صنعتی***

تفاوت بین انقلاب و تکامل

Early Carriage

Evolution

More Fancy

Revolution

Early Automobile

Vintage Analog Phone

Evolution

Fancy Digital Phone

Revolution

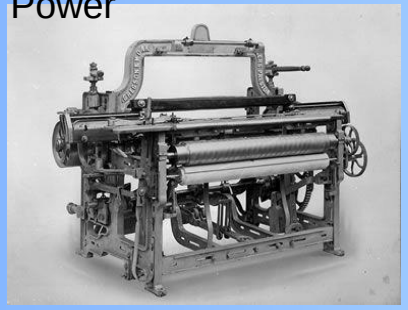
Smart Internet Phone

- Evolution - A gradual process in which something changes progressively from one stage to another
- Revolution - A total turn around; a sudden, complete, or fundamentally radical change in something

مروری بر انقلاب های صنعتی

Industry 1.0
FIRST
Industrial Revolution

Key Change:
Introduction of Mechanical Production Equipment driven by Water and Stream Power

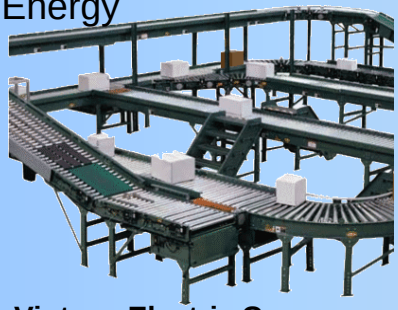


18th Century Mechanical Loom

End of 18th Century

Industry 2.0
SECOND
Industrial Revolution

Key Change:
Introduction of mass Manufacturing Production lines powered by Electric Energy

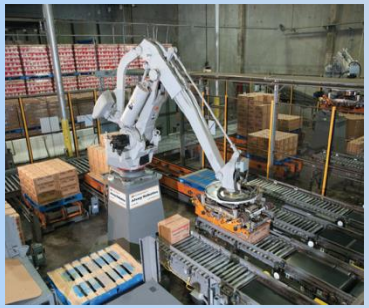


Vintage Electric Conveyor Belt

End of 19th Century

Industry 3.0
THIRD
Industrial Revolution

Key Change:
Introduction of Electronics, PLC Devices, Robots and IT to automate Production



PLC Driven Robots

Q4 of 20th Century

Industry 4.0
FOURTH
Industrial Revolution

Key Change:
Introduction of IoT and Cyber-Physical Systems driven by Augmented Reality & Real Time Intelligence

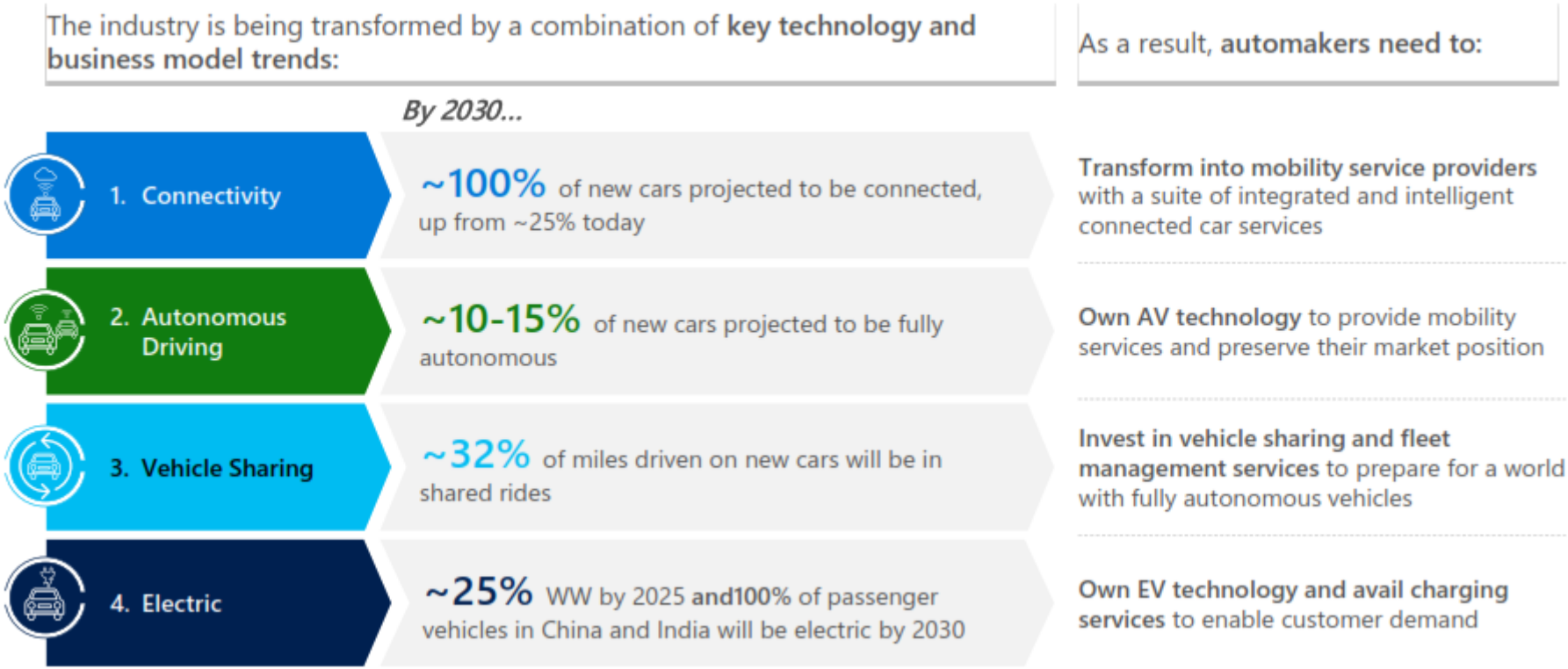
Augmented Reality Driven CPS

Start of 21th Century

Level Of Complexity

روندهای آینده

روندهای آینده صنعت خودرو



۵ روند فناورانه در خودروهای آینده

electrified

The transition to emissions-free individual mobility would hardly be possible without the electrification of the drive train. First, there is the issue of local components – the fact that cars now only emit very low levels of harmful substances, dust and noise. It also seems that going "emissions-free" will be a global initiative: The idea is that the electricity used to charge the vehicles will come from renewable sources to ensure CO_2-neutral mobility.

autonomous

The rapid progress made in areas such as artificial intelligence, machine learning and deep neural networks make it possible to achieve what until recently seemed utopian – namely the development of autonomous vehicles, which require no human intervention even in complex traffic situations. This will completely redefine the use of individual mobility platforms. New application scenarios are emerging that would have been unthinkable just a few years ago.

۵ روند فناورانه در خودروهای آینده

shared

For several years, many big cities have offered car-sharing facilities. While these are currently often run as pilot projects or citizen initiatives, sharing concepts will become economically viable with the introduction of autonomous vehicles. It will no longer be necessary to search for a shared vehicle in the surrounding area: instead it will be possible to order vehicles to wherever the user happens to be via a convenient "on demand" service.

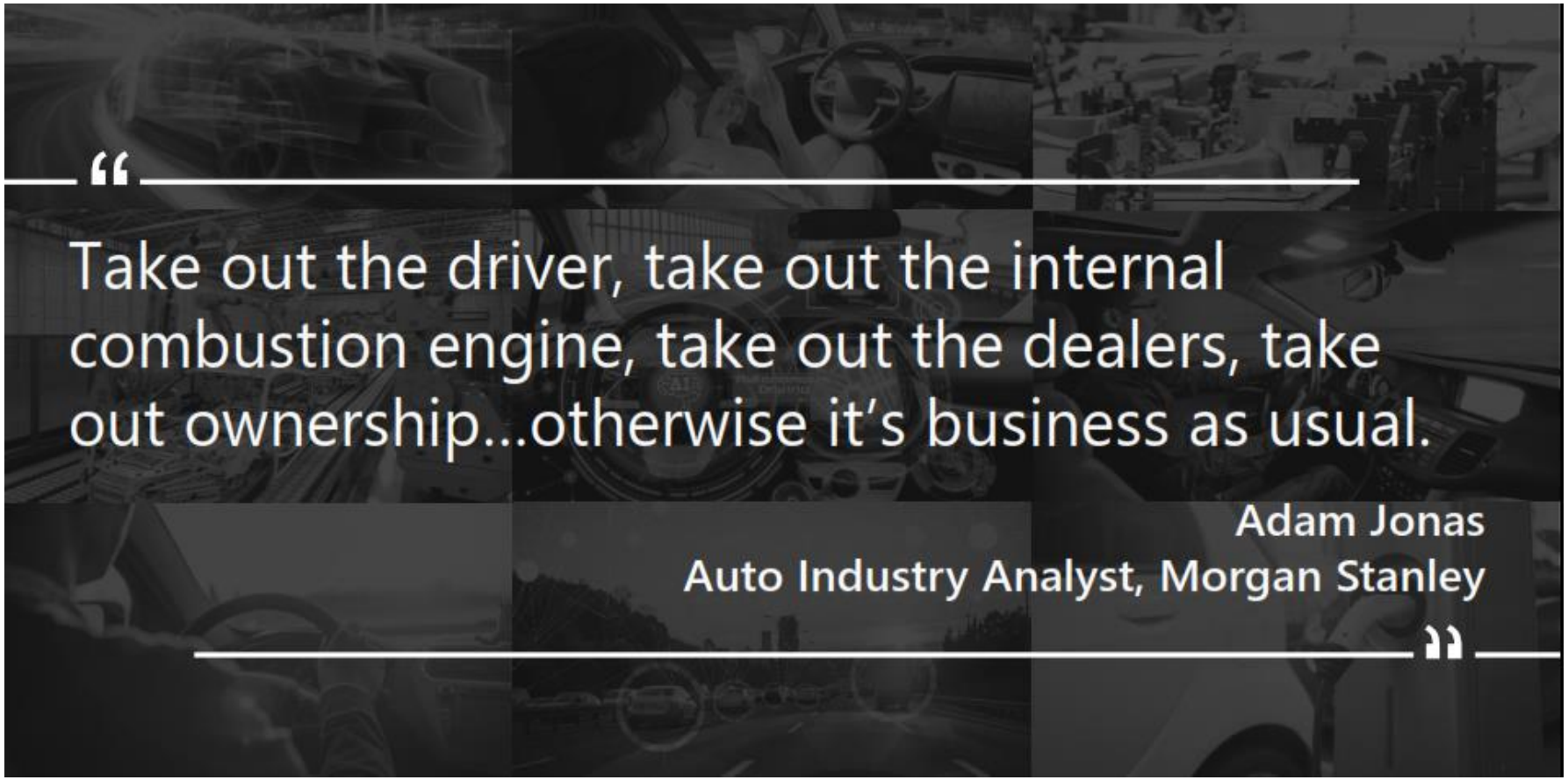
connected

The fourth "easey" dimension is the networking of cars with the outside world – summarised by the concept of the Connected Car. This term actually represents two concepts at once. On the one hand, it applies to Car2Car and Car2X communication, which is the networking of the car with other cars or with the transport infrastructure (such as traffic lights). On the other hand, the term also covers the networking of vehicle occupants with the outside world. In future, they will be able to communicate, work, surf the internet or access multi-media services during the journey.

yearly updated

The development topics of electrified, autonomous, connected and shared will lead to a clear increase in the rate of innovation within the automotive industry. Model cycles of five to eight years, which have always been common in this sector, could soon be a thing of the past. Instead, the range of models will be updated annually in order to integrate the latest hardware and software developments. As customers will naturally not want to buy a new vehicle every year due to the high purchase costs, the short innovation cycles will enter the market primarily through regular upgrades of shared vehicles.

در مورد آینده



روند فناوری خودرو

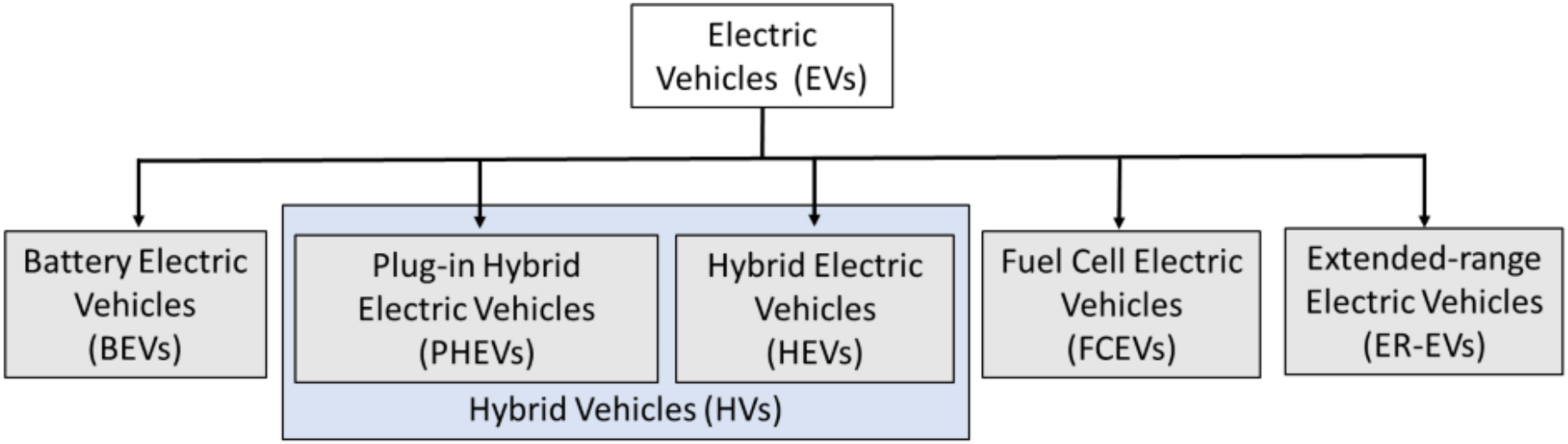
خودروهای آینده

خودروهای خود ران

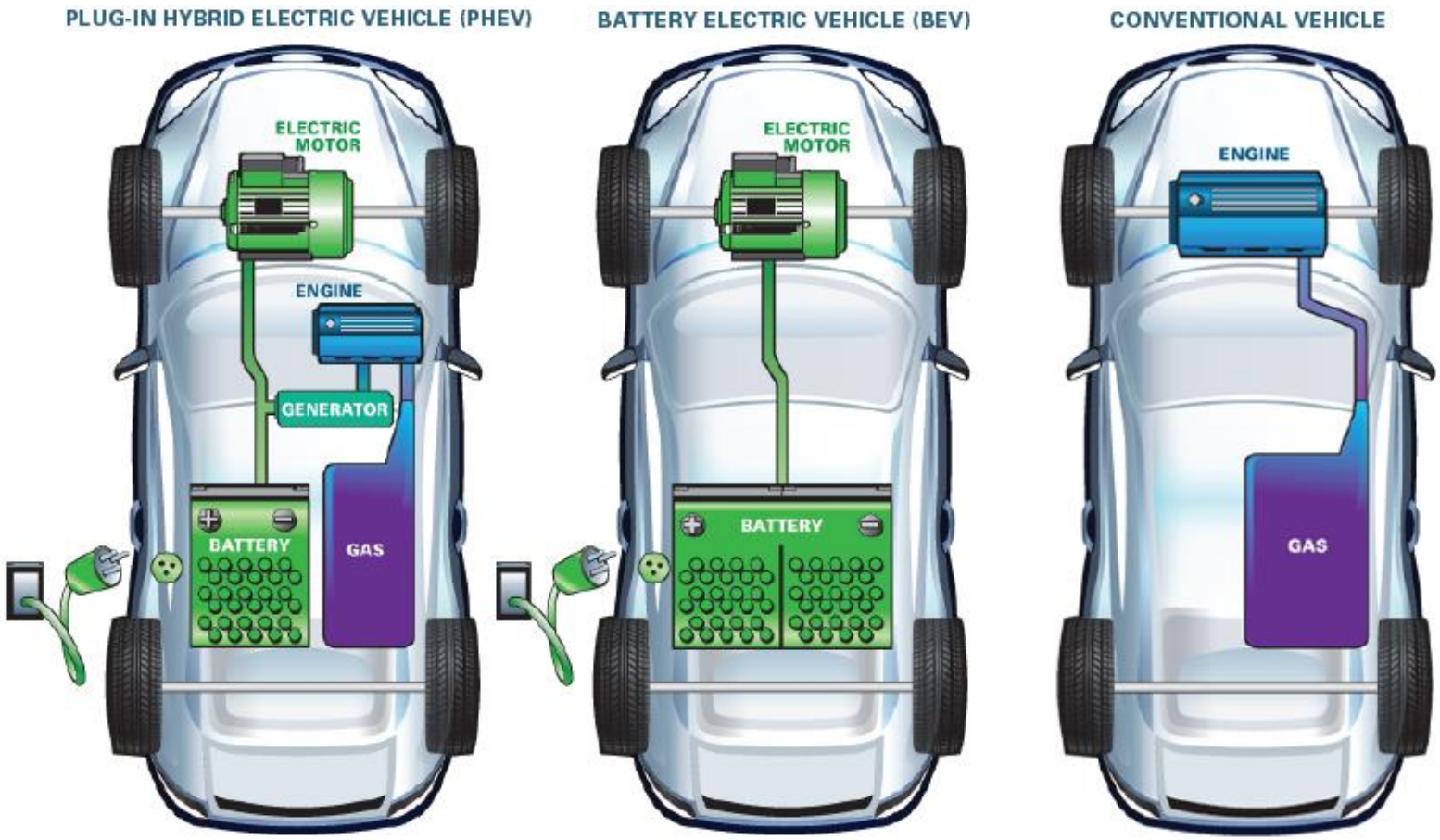
خودروهای الکتریکی

خودروهای متصل

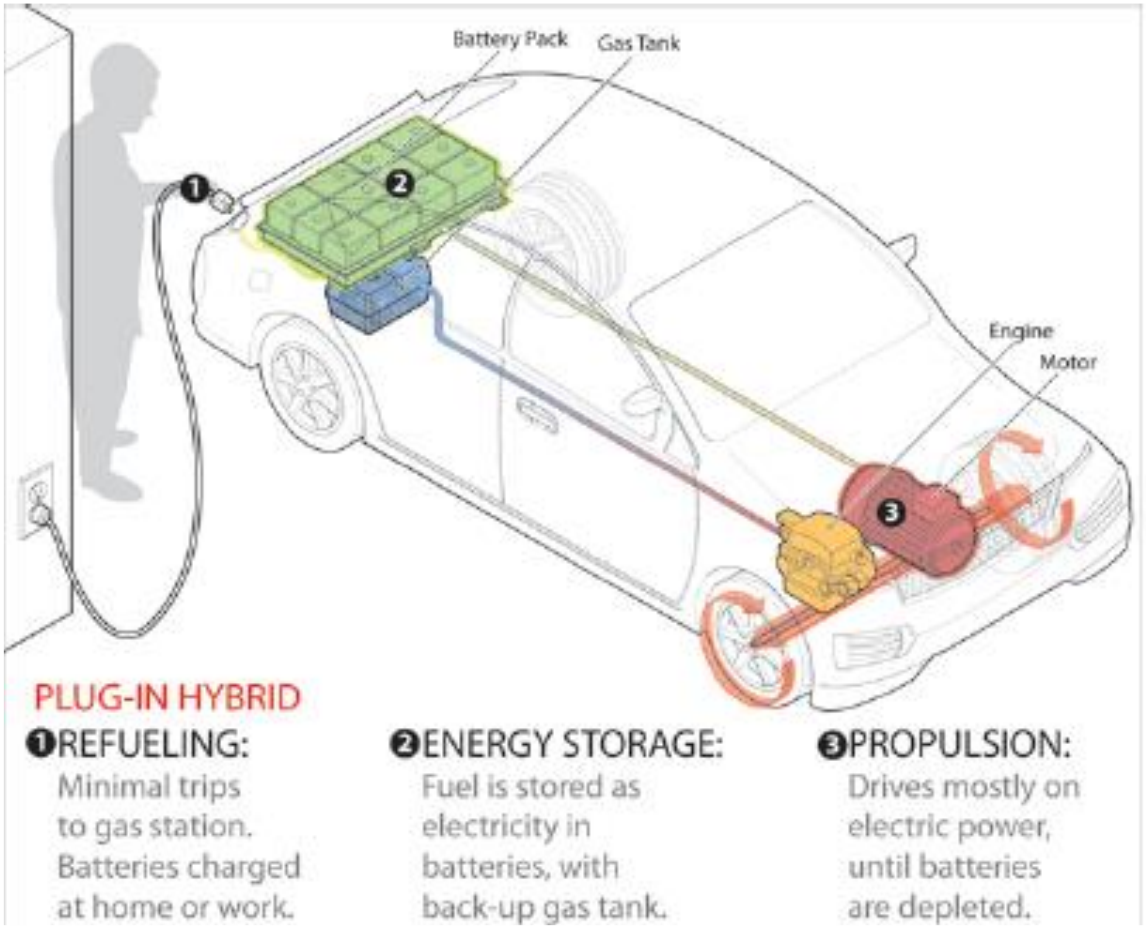
انواع فناوری خودروی الکتریکی



انواع فناوری خودروی الکتریکی



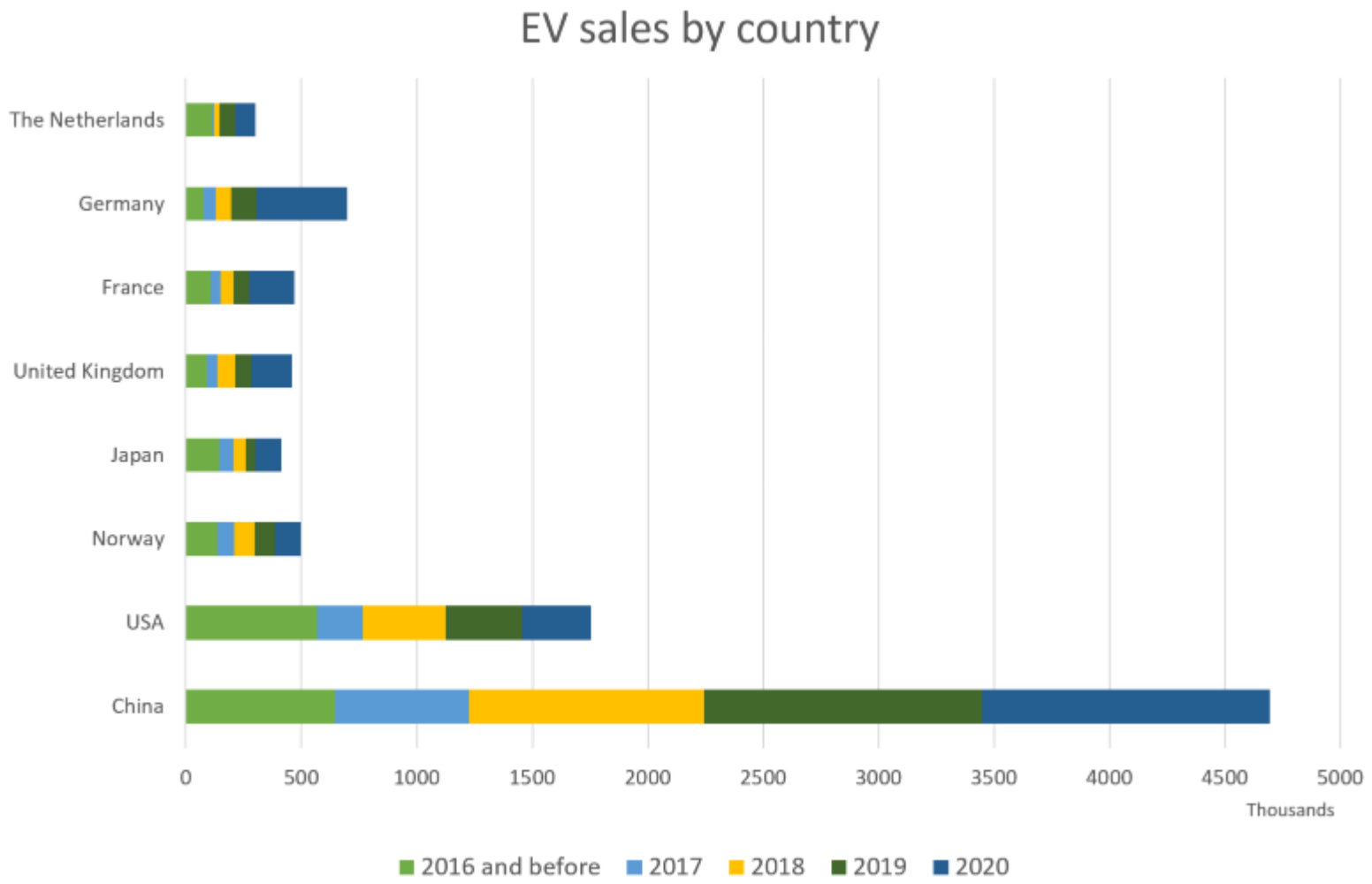
Plug-in hybrid



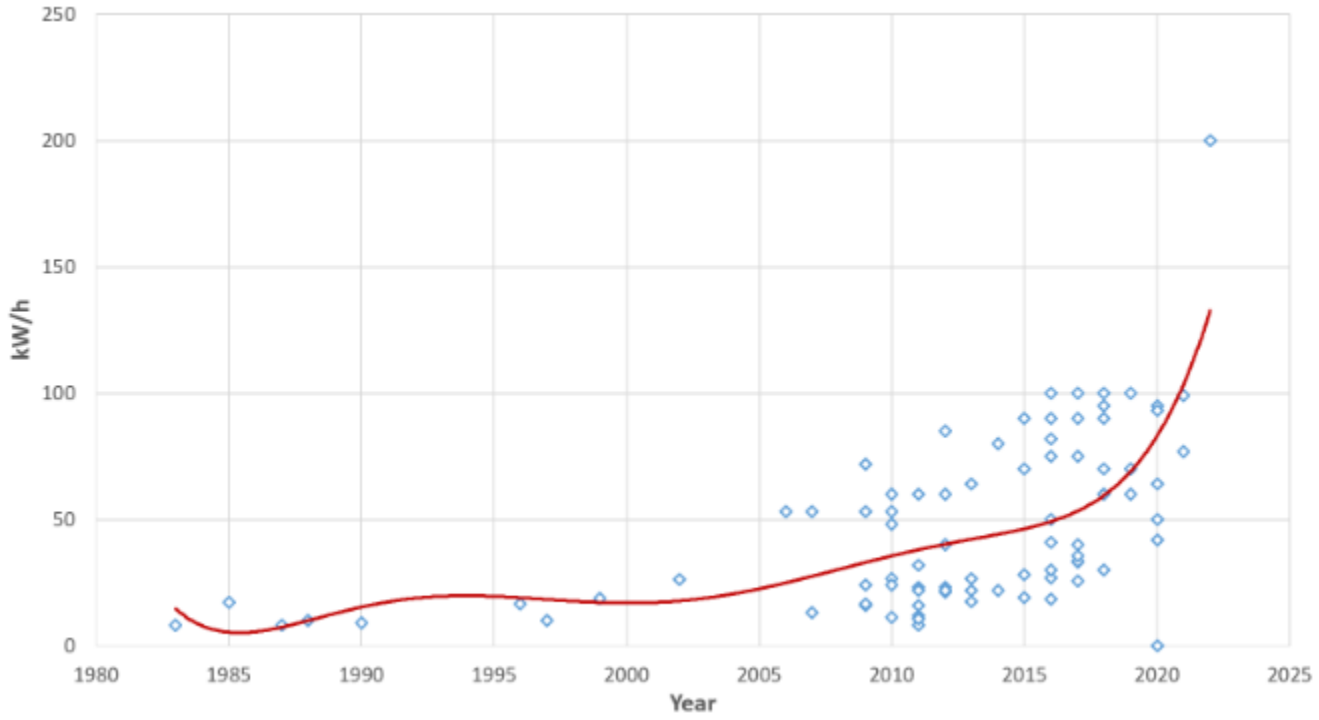
فروش خودروهای الکتریکی

Country	2013	2014	2015	2016	2017	2018	2019	2020
Norway	6.10%	13.84%	22.39%	27.40%	29.00%	39.20%	49.10%	55.90%
Iceland	0.94%	2.71%	3.98%	6.28%	8.70%	19.00%	22.60%	45.00%
Sweden	0.71%	1.53%	2.52%	3.20%	3.40%	6.30%	11.40%	32.20%
The Netherlands	5.55%	3.87%	9.74%	6.70%	2.60%	5.40%	14.90%	24.60%
China	0.08%	0.23%	0.84%	1.31%	2.10%	4.20%	4.90%	5.40%
Canada	0.18%	0.28%	0.35%	0.58%	0.92%	2.16%	3.00%	3.30%
France	0.83%	0.70%	1.19%	1.45%	1.98%	2.11%	2.80%	11.20%
Denmark	0.29%	0.88%	2.29%	0.63%	0.40%	2.00%	4.20%	16.40%
USA	0.62%	0.75%	0.66%	0.90%	1.16%	1.93%	2.00%	1.90%
United Kingdom	0.16%	0.59%	1.07%	1.25%	1.40%	1.90%	22.60%	45.00%
Japan	0.91%	1.06%	0.68%	0.59%	1.10%	1.00%	0.90%	0.77%

فروش خودروهای الکتریکی



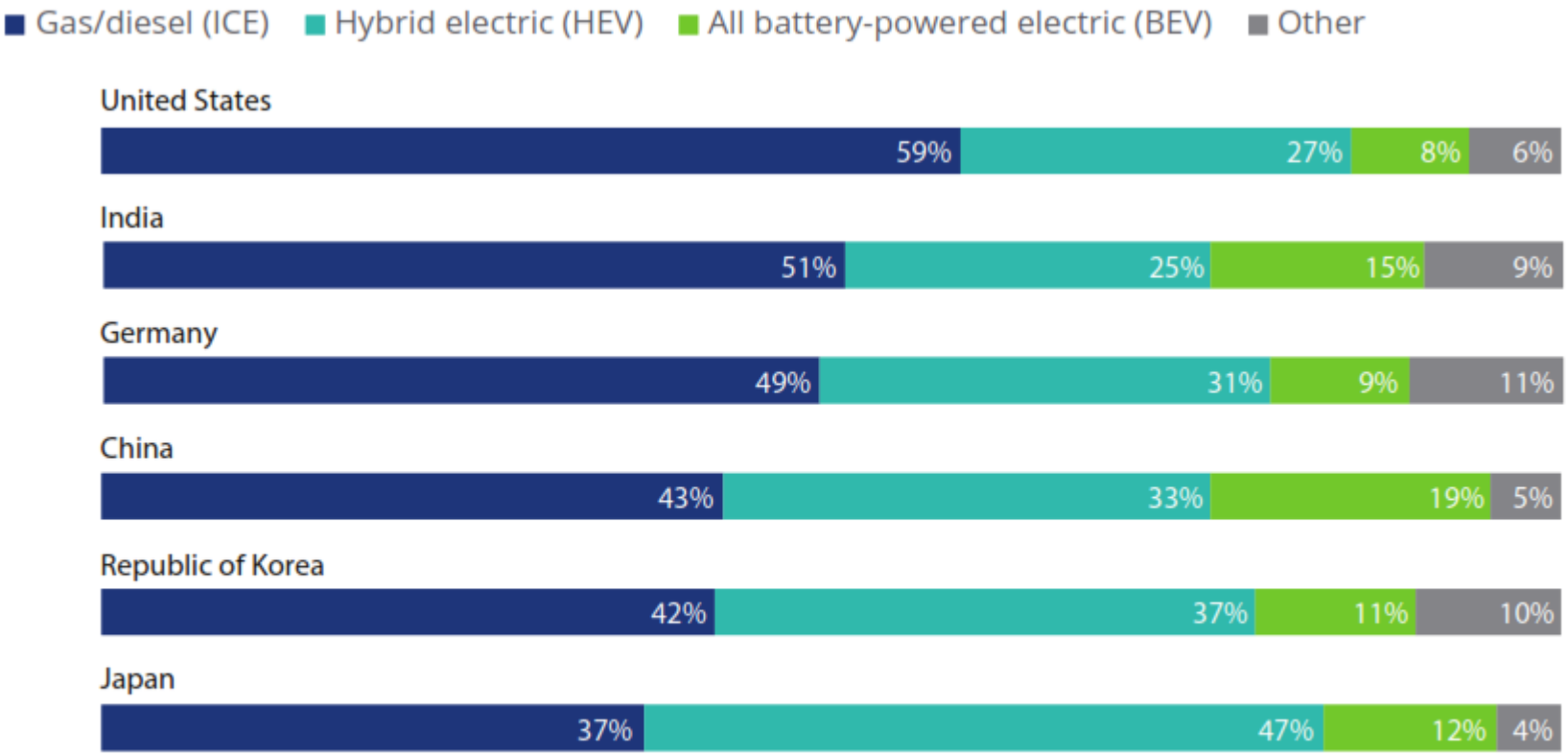
توسعه ظرفیت باتری



Evolution of the battery capacity since the mid 80s until now


V2X
زیرساخت ارتباطات
ورود به داخل ماشین
به صورت Keyless
ارتباط متقابل
وسایل نقلیه
بلوتوث و ارتباط از
راه دور
INFOTAINMENT
TPMS
پورت OBD II
ضد سرقت

ذائقه مشتری



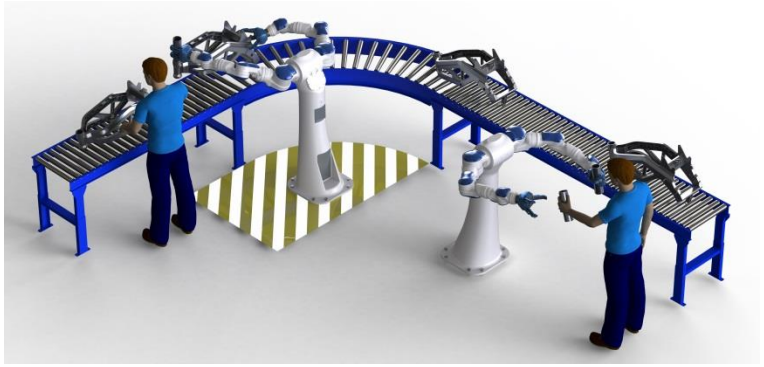
Note: "Other" category includes ethanol, compressed natural gas, and hydrogen fuel cells.
Source: 2020 Deloitte Global Automotive Consumer Study.

تولید متصل

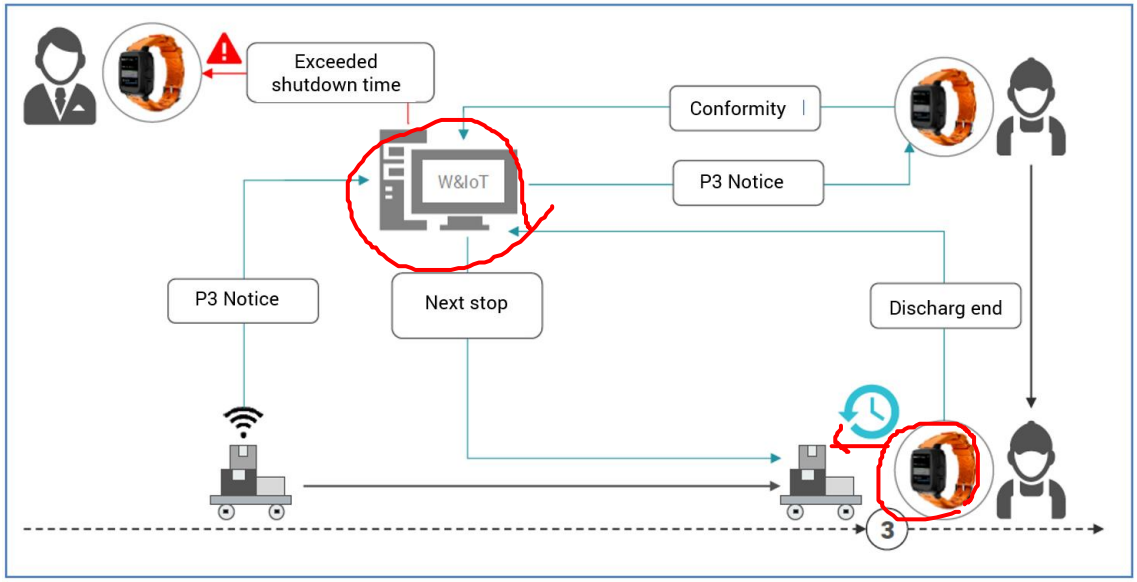
مطالعه موردی: کارخانه هوشمند در کانتیننتال

- Active RFID tags and Geo-location are used to move the tire components throughout the factory

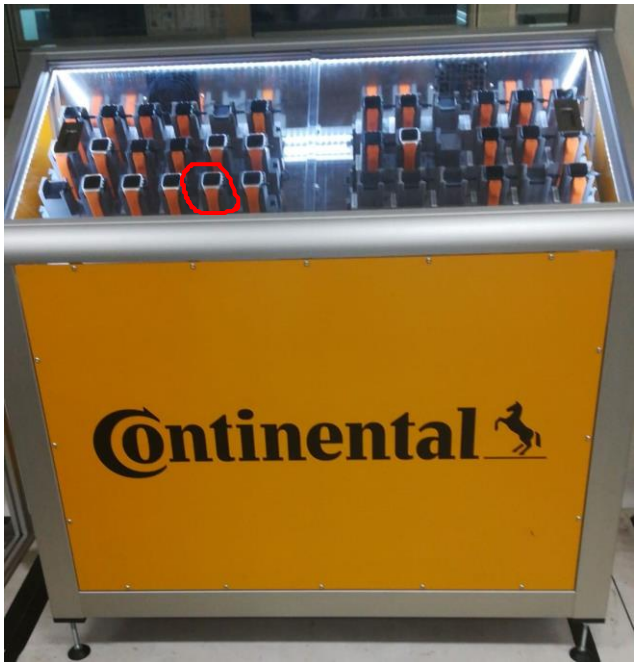
- Collaborative robots
  - Robots are “shown” how to do a task once and then they can repeat that action
  - Reduces risks of injuries and reduces the need for additional assisting employees



اتصال پرسنل به سیستم تولیدی



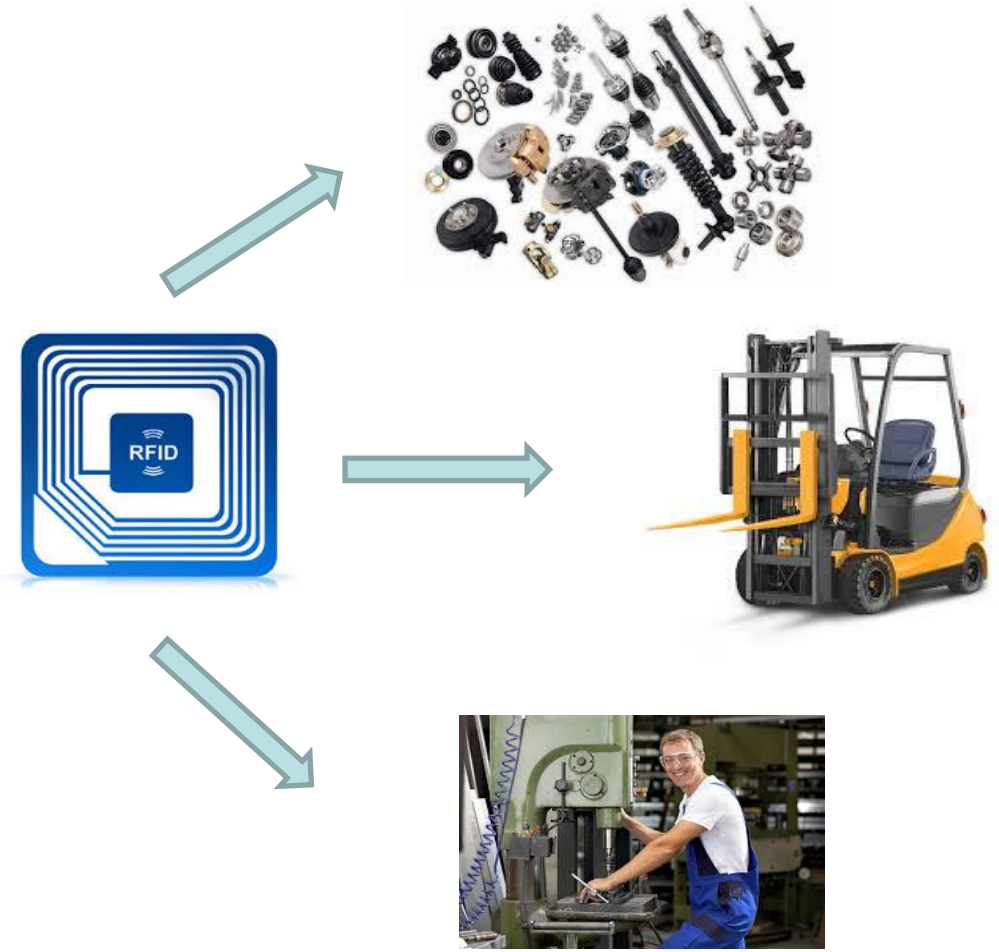
When the worker finishes unloading materials from the AGV, he must inform the system through his Smartwatch (End of Unloading option), and the system will issue an order to the AGV to resume its route to the next stop



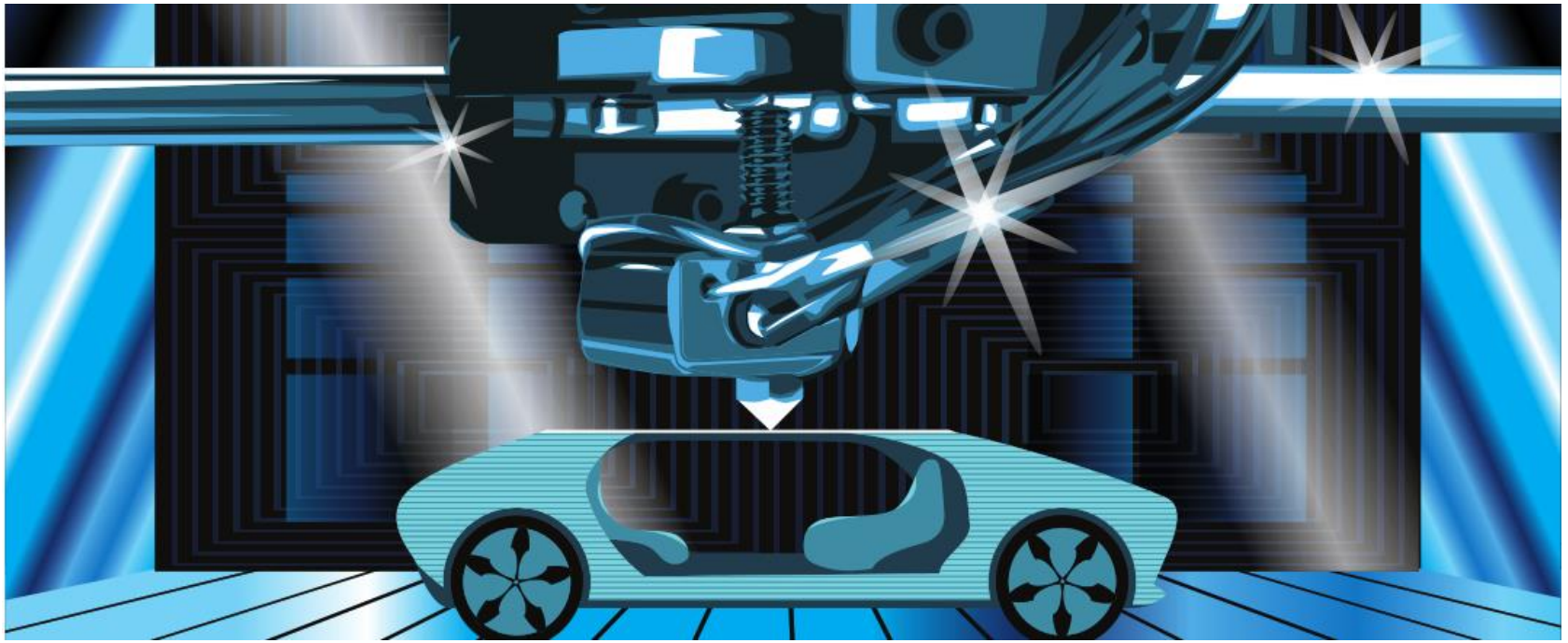
مطالعه موردی: سیستم تولیدی متصل در شرکت بوش

کاربرد سنسورها در هوشمندسازی تولید

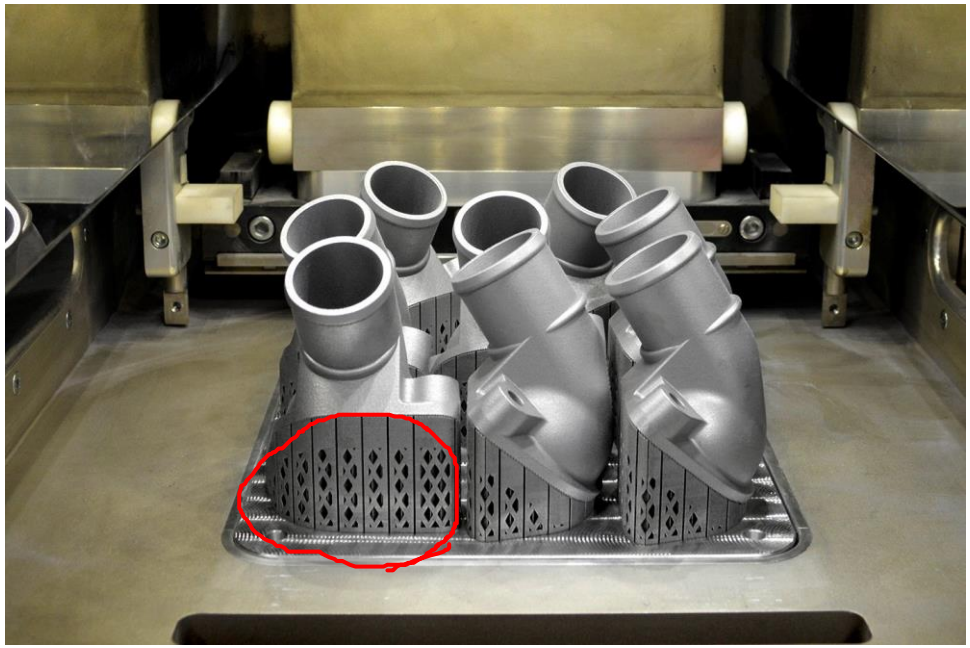
- Sensors are attached to components, forklifts, employees and other assets



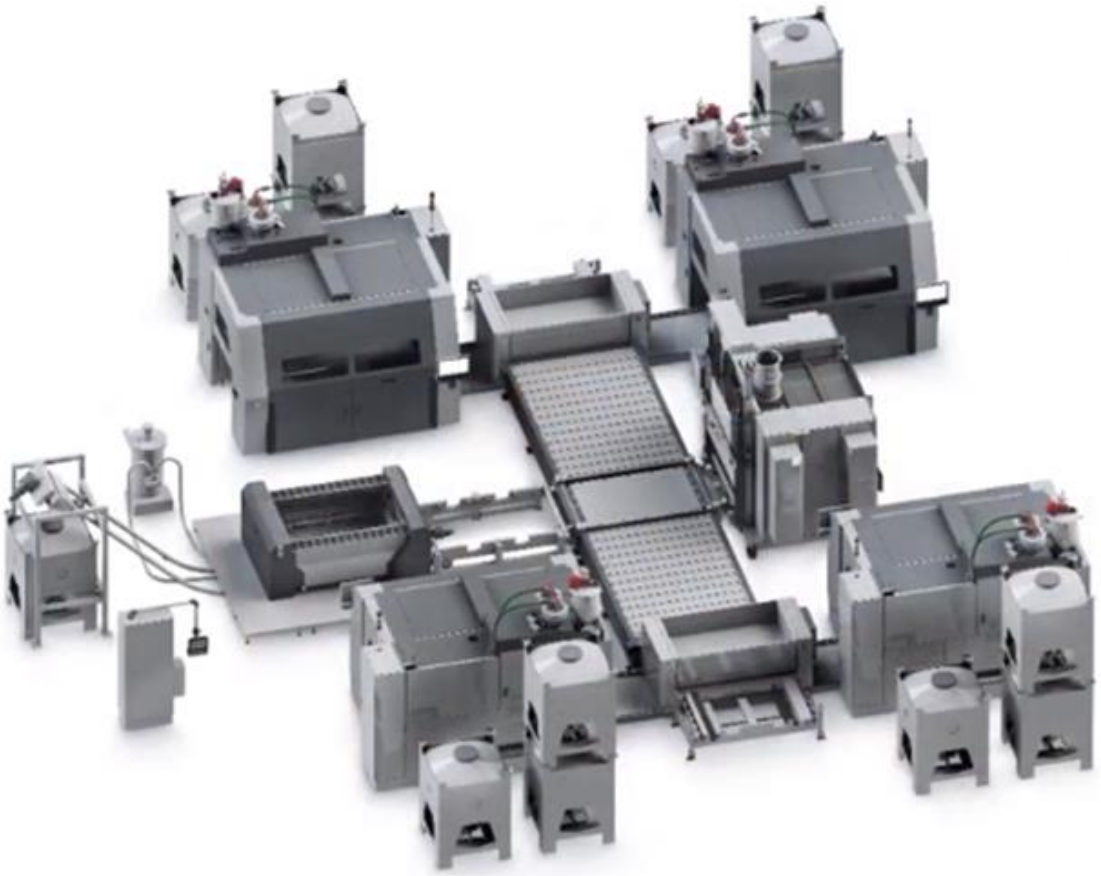
استفاده از قابلیت پرینت سه بعدی



سبک سازی به کمک پرینت سه بعدی



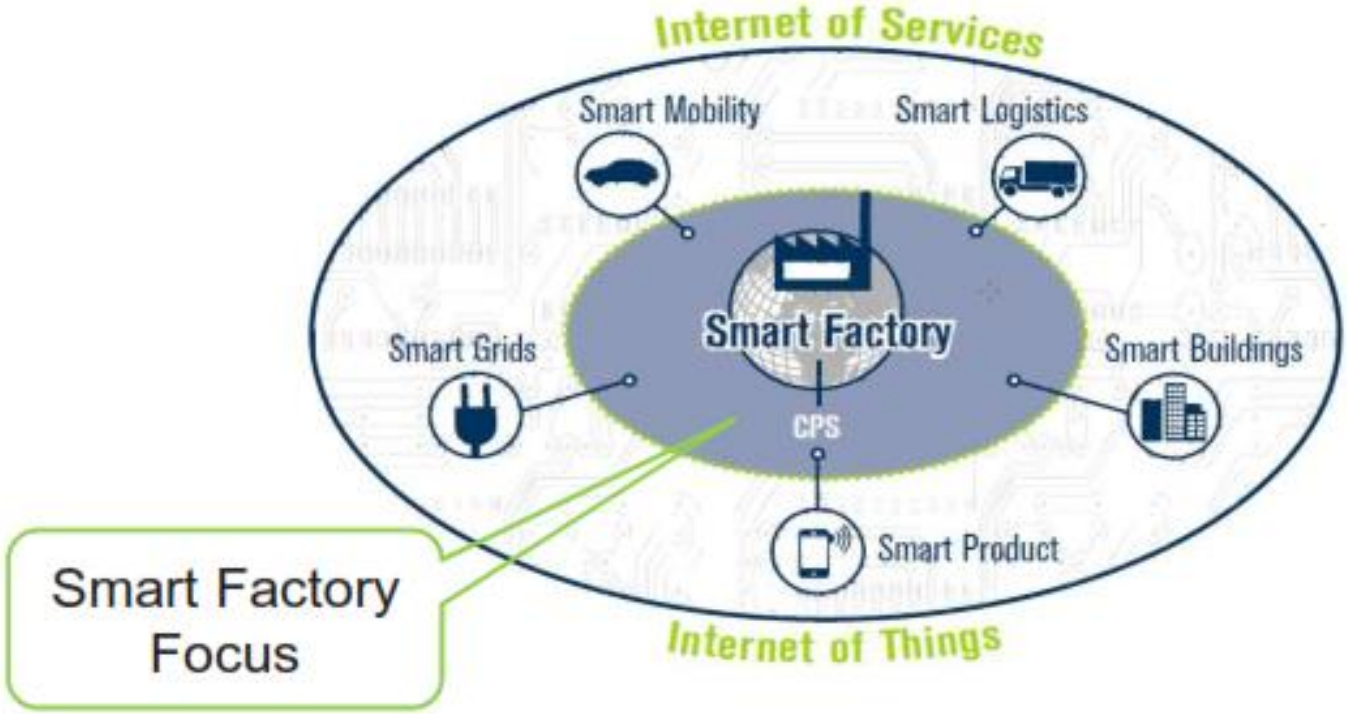
خط تولید اتوماتیک ماهیچه با استفاده از پرینت سه بعدی



ExOne

تولید ماهیچه با استفاده از پرینت سه بعدی

کارخانه هوشمند

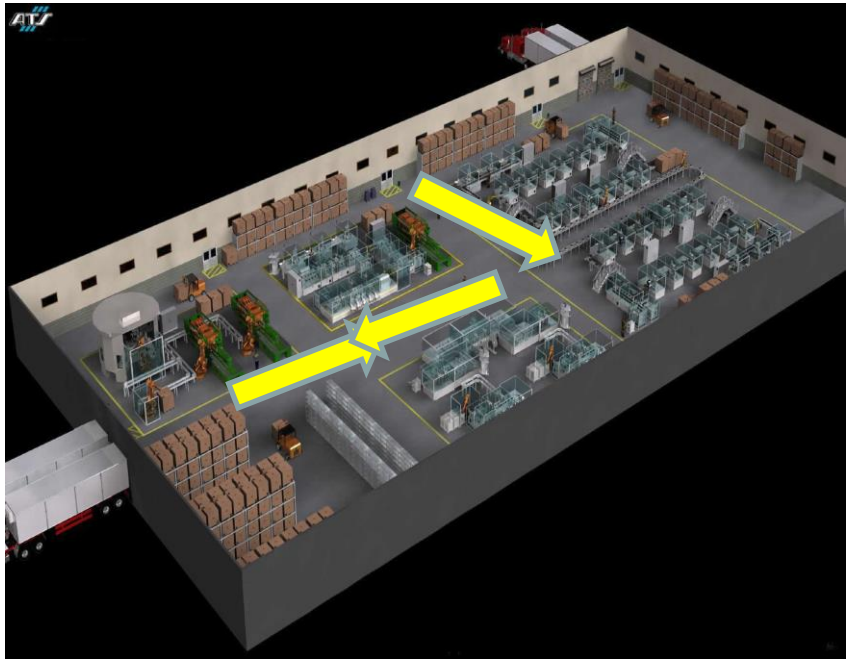


کارخانه هوشمند

- Smart Factory
  - Predictive Maintenance
  - Predictive Quality
  - Manufacturing Simulation
  - Manufacturing Optimization
  - Complexity Management
  - Smart Energy Mgmt.
  - Smart Planning
  - Smart Shop Floor Management
  - Smart Logistics
  - …
- Out of Scope
  - Smart Grids
  - Smart Services
  - Smart Products

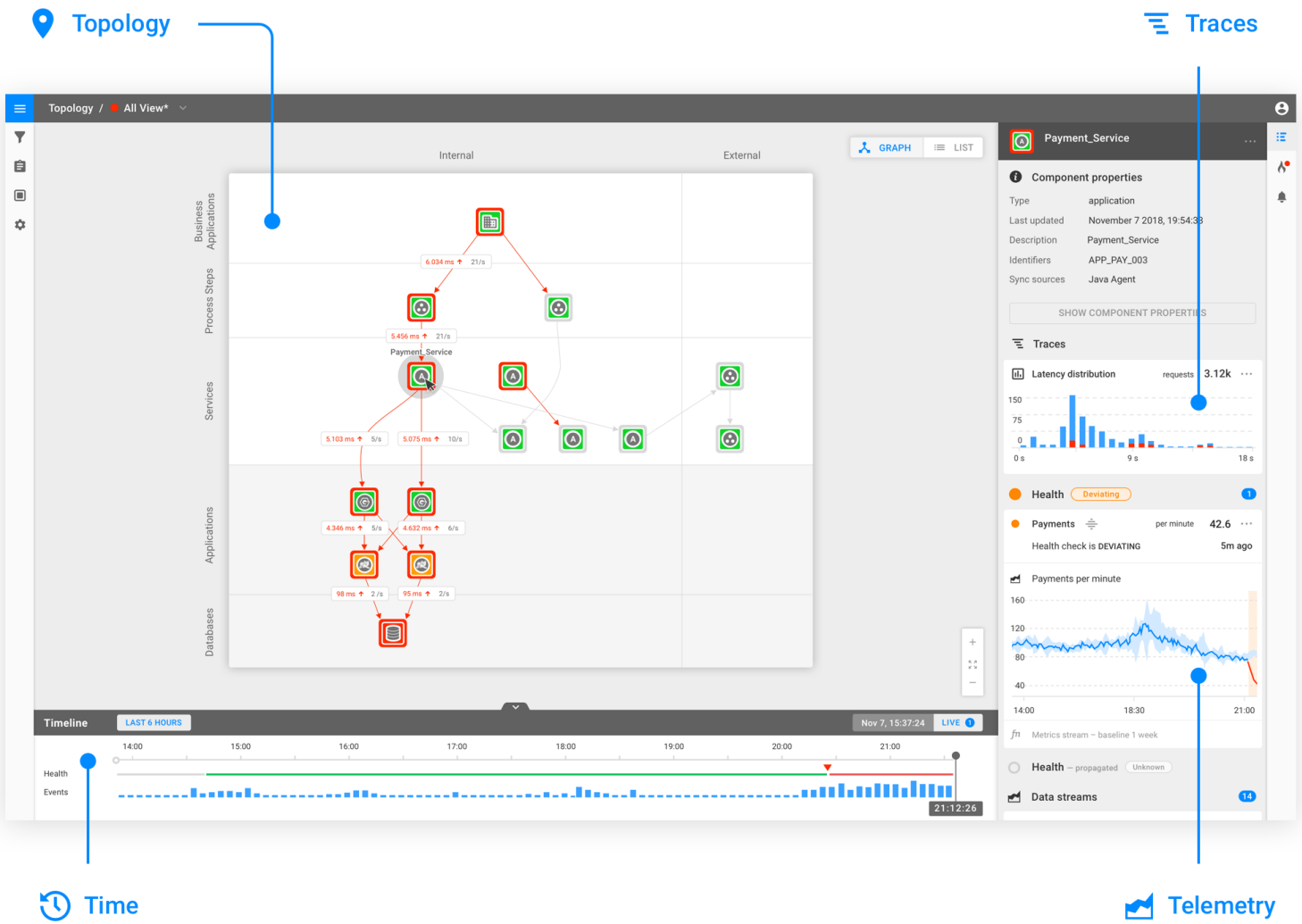
- Efficiency Improvements (KPI's)
  - Machine Productivity
  - Labor Productivity
  - Quality Performance
  - Delivery Performance
  - Scrap
  - Inventory Range
  - Inventory Accuracy
  - Energy Cost Ratio
  - Supplier Performance
  - …

- By geolocating the sensors, one can see how people and products are moving



Processes can be streamlined and production time reduced.

حل مساله به صورت هوشمند



کنترل موجودی

- Sensors on containers can determine when a product is running low
- Employees will be alerted to proactively re-order the parts when a certain level is reached or orders can be automatically placed with suppliers

Components will not run out or run low
Reduced costs of production
More uptime for factories which leads to higher productive levels

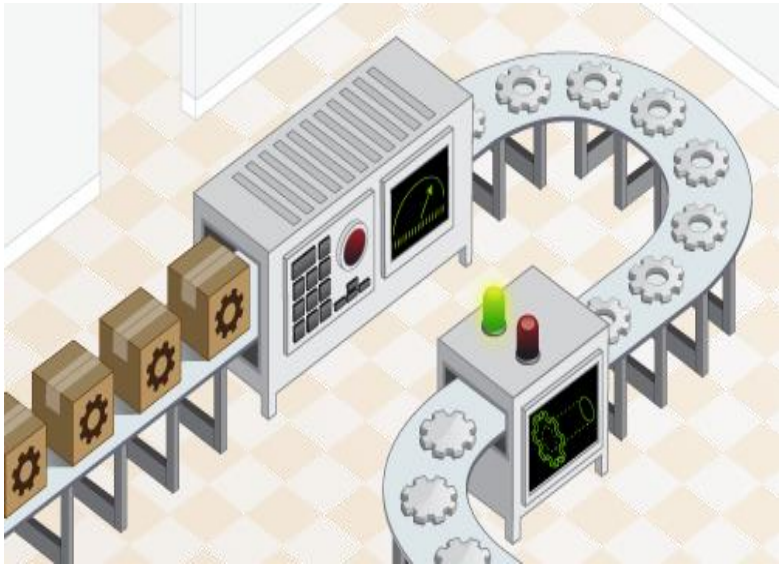
کنترل موجودی

- Sensors can also be used to determine if a container is reaching its capacity. This could trigger an alert for a forklift to remove the container and replace it with an empty one. Can also be used for waste management

Components will not overflow from a container
More uptime for factories which leads to higher productive levels

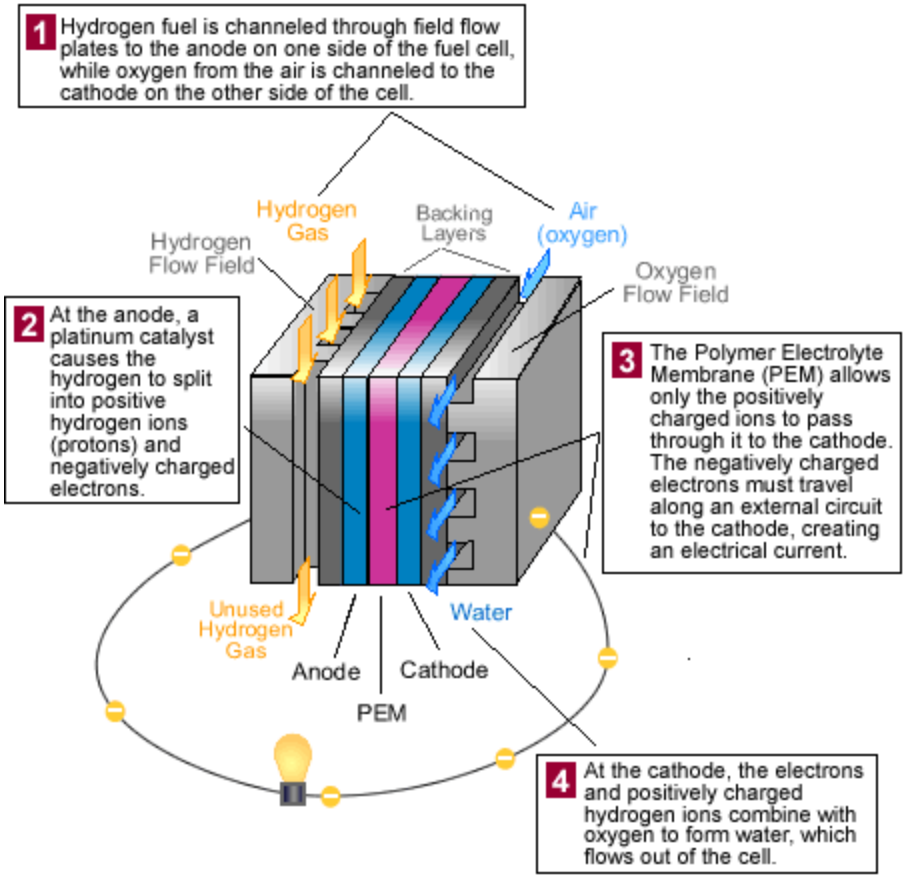
کنترل کیفیت در سیستم تولیدی متصل

- **RFIDs attached to products can be used to tag defective products**
- **If over a certain number, an employee can be alerted to see if there is a bad batch of components or if an adjustment needs to be made to the machinery**
- **Employees can be alerted if the problem is the result of a defective part**
- **If an adjustment is needed, it can be automatically made in real-time**



Product quality is controlled and course corrections are made while product is still moving through the production line


Q & A time


1 Hydrogen fuel is channeled through field flow plates to the anode on one side of the fuel cell, while oxygen from the air is channeled to the cathode on the other side of the cell.
Hydrogen Gas
Backing Layers
Air (oxygen)
Hydrogen Flow Field
Oxygen Flow Field
2 At the anode, a platinum catalyst causes the hydrogen to split into positive hydrogen ions (protons) and negatively charged electrons.
3 The Polymer Electrolyte Membrane (PEM) allows only the positively charged ions to pass through it to the cathode. The negatively charged electrons must travel along an external circuit to the cathode, creating an electrical current.
Unused Hydrogen Gas
Water
Anode
Cathode
PEM
4 At the cathode, the electrons and positively charged hydrogen ions combine with oxygen to form water, which flows out of the cell.