New jobs
created by
Industrial IoT
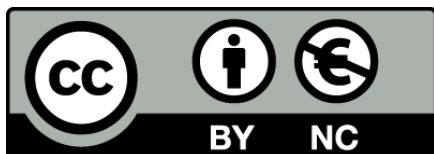
Job and skills for
Industry 4.0

New jobs and skills needed for Industry 4.0

The Internet of Things is changing the demand for skills in the industry. The future of manufacturing companies lies in the adoption of advanced technologies.

IoT has enabled entire working processes to link to one another via the internet which has led to the rise of the smart factory. Advancing technologies and evolving manufacturing processes require a highly-trained, agile workforce. As the Industrial IoT expands and IT and operational technology systems converge, companies need to equip workers with new skills to enable this convergence and take advantage of newly available information that can drive better decisions.

To keep up, workers need to be problem-solvers, creative thinkers and self-directed learners. The most effective education will include competency-based, multimedia instruction using cooperative work/learning assignments and courseware with simulations of real-life manufacturing situations.

The most frequently exposed new jobs and required IT skills in Industry 4.0 are presented below (summarized from various articles published online).

Cybersecurity

Cybersecurity is the protection of computer systems and networks from the theft of or damage to their hardware, software, or electronic data, as well as from the disruption or misdirection of the services they provide.

Knowledge of industrial IIoT standards will also factor heavily in the required knowledge base of these individuals.

Connected to this field we can emphasise *Cybersecurity professionals*.

The rise in IIoT will lead many companies to turn to cybersecurity professionals, because of the need to protect the influx of data.

Cybersecurity professionals will not only need to monitor all of the equipment, but also learn how to keep the data secure, and how to mitigate inevitable attacks.

Data scientists

Data is the lifeblood of Industry 4.0 so people who work with it, who understand it, who know how to glean intelligence from it will be highly prized. The IoT deployments fueling Industry 4.0 will generate vast quantities of data. All of that data will need to be captured and analyzed so it can be used to improve machine performance, reduce resource consumption, assist in quality control, make supply chains more efficient and introduce new products and services. Then there is the continued improvement of production lines as more capable machines are added and networked.

Currently, industrial data scientists are a strongly growing job profile in consumer and e-commerce companies. Now they are also entering the world of industrial IoT jobs.

The role of a data scientist is to extract and prepare data, conduct advanced analytics, and apply the findings to improve products or production. Industrial data scientists must understand both manufacturing processes and IT systems and possess strong root cause analysis skills to identify correlations and draw conclusions.

Programming skills will be required, including capabilities to use both statistical programming languages, such as "R," and general-purpose programming languages, such as Python. Individuals in this role will need the flexibility to address topics continuously or respond to specific requests, as well as be able to work onsite or remotely.

IoT professionals included in China's list of new official jobs

1. *artificial intelligence engineering and technical personnel*
2. *Internet of Things engineering and technical personnel*
3. *big data engineering technicians*
4. *cloud computing engineering technicians*
5. *digital managers*
6. *building information model technicians*
7. *e-sports operators*
8. *e-sportsmen*
9. *drone drivers*
10. *agricultural managers*
11. *IoT installation and commissioners*
12. *industry robot system operator*
13. *industrial robot system operator*

Networking

Connecting machines to each other and to the command and control systems that will oversee them will require the skills of a highly-skilled network engineer. They will have to be up to date on WANs, edge networking and fog computing as well as next-gen 5G networking technologies, WiFi, and the low-power LAN protocols that IoT devices often run on.

They will need to appreciate the challenges imposed by connecting systems and machines that were never designed with networking in mind. The cloud factors prominently in Industry 4.0 ecosystems so moving data around efficiently with as little latency as possible will be a priority. Network function virtualization (NFV) and software defined networking (SDN) will also be valuable skills to know as will open source technologies.

Software engineers, application developers, and programmers

These jobs will be required in various forms from one end of the Industry 4.0 ecosystem to the other. Manufacturers will need experts to write and modify programs for machines as well as develop new interfaces for their human counterparts to interact with them. There will be a raft of data visualization and dashboarding jobs because many of these processes will require a "digital twin" so operators can oversee and interact with operations from a network operations centre (NOC).

Industrial computer engineer/programmer. The IT solution that is designed by the IT solution architect gets brought to life by the industrial computer engineer.

Three kinds of programming skills are necessary for these kinds of industrial IoT jobs.

1. Firstly, the programmer should be experienced in some of the major general-purpose languages such as Java, C++, or Python.

2. Secondly, he/she should be able to work with specific applications: e.g., Matlab and Simulink for industrial simulations or R for general data analytics programming.

3. Finally, there is an important hardware component in the industrial programming environment.

Robots and intelligent devices need to be programmed. Today, it requires a combination of languages such as C, VHDL, and proprietary languages such as Kuka's KRL. Computer engineers also need to be aware that the increasing shift to cloud architectures brings in new programming paradigms such as components as services, an increasing focus on lightweight objects and layered services, as well as new protocols and lightweight programming languages such as node.

Architects

These are the big picture guys. IT architects will have a role to play helping systems engineers on the operational side meld the physical and logical worlds. People in this role will be required to understand the full dimensions of a company's existing business, its processes, and its digital transformation goals, and then figure out how to tie it all together using technology.

There will also be new positions created that require a strong engineering mindset coupled with someone who understands code and networking equally well, e.g. mechatronics. The roles and responsibilities are keep everything on the shop floor running and fix it when it breaks.

"Your success with Industry 4.0 will depend on skills and knowledge," PwC's report states. "Your biggest constraints may well be your ability to recruit new employees or train existing ones who can put digitization into place. You need to introduce new roles in your company, like data

scientists, user interface designers, or digital innovation managers. And you'll probably need to update existing job profiles to take into account new digital skills."

IT/IoT solution architect

IT systems in manufacturing companies continue to become more complex and important.

In order to manage the increasing amount of machines and products that are connected in real-time, IT solution architects take on the responsibility for the overall system design. They are involved in mapping the business needs to system requirements and technical requirements. Together with other technical architects they produce the technical specifications, integrating different technologies, platforms and people.

The IT solution architect has end-to-end responsibility for applications such as remote operation centers, predictive maintenance, or assisted operations through augmented reality. As with the industrial data scientist, the IT solution architect possesses a broad range of skills, relating business know-how and IT experience with data management, application, and technology skills.
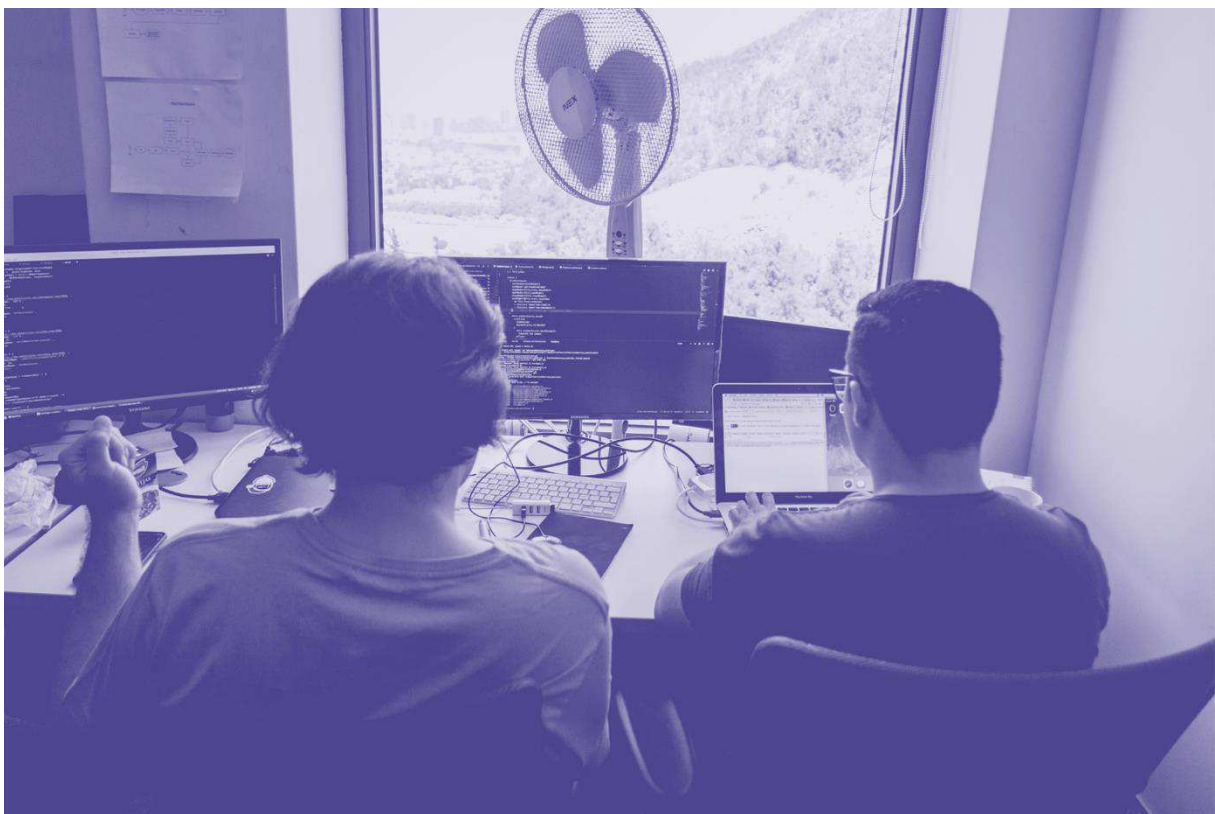
Industrial UI/UX designer

Another job family that is slowly migrating from the consumer world to the industrial world are user interface (UI) and user experience (UX) designers.

From intuitive manufacturing dashboards on tablets and mobile phones, to machine interfaces and robot interaction, augmented reality applications in operations and maintenance and

finally the service and product design for the users of industrial equipment – the industrial environment will see a dramatic increase of user interfaces that need to be optimized for usability.

The broad responsibility of a UX designer is to ensure that the product logically flows from one step to the next. UI designers on the other hand are in charge of designing each screen or page with which a user interacts and ensuring that the UI visually communicates the path that a UX designer has laid out.

Both job functions are increasingly becoming more important in the industrial environment. Basic knowledge of industrial software architecture design and state-of-the-art programming paradigms are a must for any industrial UI/UX designer.

Other interesting Industrial IoT jobs

1. *Electricians and industrial technicians*

   Trained electricians and industrial technicians will be in great demand, as companies will need professionals to actually install the equipment necessary for IIoT. These positions will likely only increase as new technology continues being developed.

2. *Maintenance managers/plant managers*

   The job of a maintenance manager is to keep a plant's machines operating, which could mean managing hundreds of machines.

   However, IIoT has dramatically improved the speed and ease of identifying maintenance issues and preventing them before they occur. IIoT provides unprecedented data and analysis shedding light into the operations of a plant. As a result, maintenance managers will be able to move beyond maintaining the condition of their plant and start actively improving their plant.

4. *Corporate purchasing*

   Individuals responsible for a company's capital expenditure decisions will also benefit from IIoT data. The data can provide insights into what portions of the company would benefit most from monetary investments.

   IIoT data can be leveraged to calculate ROIs on upgrades or new equipment and understand where an organization's money is best spent. An abundance of IIoT data will make purchasing decisions simpler, faster and more justifiable."

Robot coordinator

Semi-autonomous, autonomous, and even humanoid robots are entering the shopfloors of factories. See for example the Rethink Robotics Baxter line of collaborative robots.

The role of robot coordinator will be a newly created industrial IoT job with the responsibility to oversee the robots on the shop floor and respond to malfunctions or error signals. The coordinator will carry out both routine and emergency maintenance tasks and involve other experts as needed. If a robot must be taken out of service, the coordinator will replace it with a substitute in order to reduce production downtime. In many cases, manufacturers will be able to retrain machine operators to take on this role,

5. *Industrial service providers*

   The job of industrial service providers hasn't really changed in the past century. They maintain equipment on a specific schedule, and schedule teams to fix broken equipment.

6. *Agricultural Technologist*

   Agricultural technologists work to feed the planet by maximizing the food we get from our plants and animals. These technologists may specialize in soil analysis, livestock care or crop yields. To best do their jobs, these workers need data and lots of it.

7. *3-D Printing Engineer*

   3-D printing technology (also called additive manufacturing) has been around for many years, but recent advances are making it a better option for a wider range of companies. In short, 3-D printers take objects modelled on computers and print them (often in plastic) layer by layer, until the object is complete.

8. *Wearable Tech Designer*

   Smaller sensors and batteries, flexible circuitry and sweat-resistant electronics are becoming more common. Savvy companies are combining these elements into wearable technology so we can adorn ourselves with all manner of geeky goods. This isn't some wild, off-the-cuff idea. More than 70 per cent of young people want wearable technology [source: Forbes].

9. *Medical Robot Designer*

   Medical robots generally incorporate robotics systems, sensors and surgical tools that work seamlessly with command software. Properly designed and deployed, these robots increase the productivity of a hospital, reduce the overall cost of health care and provide real benefits to the end patient.

10. *Data Security Expert*

    Data security experts have been a necessity since we hit power buttons on the very first computers. These experts ward off data loss caused by malfunction and also try to prevent or mitigate purposeful attacks by hackers with malice on their minds.

    The IoT means security professionals have their hands full. With billions of devices of all kinds connecting to the Internet, the chances of accidental data meltdowns will increase exponentially, as will the opportunities for intentional tampering.

11. *Cloud Computing Specialist*

    Widespread high-speed Internet access, better online storage services and cheap availability of both changed everything. Now you can store all of your documents, pictures and even videos in the cloud, a collection of computer servers that are always connected to the Internet. With your laptop, tablet, or smartphone and an Internet connection, you can view and manipulate your files in your office or 1,000 miles away

from home. And more than 80 per cent of businesses saw improvements thanks to the power of the cloud [source: Silicon Angle].

12. *E-discovery Investigator*

Digital devices, like some children, make for wonderful tattletales. They hold the evidence of many wrongdoings. You just have to find a way to tease the truth out of them. That's what e-discovery investigators and computer forensics teams do.

13. *Intermodal Transport Designers*

Intermodal freight transport is industry lingo for a means of transporting goods in a single container. Typically that container is rectangular and easy to move from a large ship to a railroad car or a semi-trailer truck. Because the contents remain in one big metal box for the duration of a voyage, there's less product damage and fewer thefts. Thanks to the IoT, containers are visible to the network from start to finish. But someone has to design and maintain that tracking system. Intermodal transport designers imagine and manage the systems that move containers in the most logical and efficient fashions.

14. *Counter Hackers*

Companies are fighting computer hackers. Instead of relying on just law enforcement computer experts, they hire their own hackers – counter hackers who anticipate attacks and actively repel them. Hackers use sophisticated software tools or sometimes social engineering schemes to access protected networks. Once they're in, counter hackers go to work.

Counter hackers have extensive training in software development and computer forensics. They can analyze an attacker's methods and even deconstruct them. For example, if a hacker manages to infect computers with malware (malicious software), the counter hacker may reverse engineer the malware to determine its purpose and mitigate its effects.

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