Security & Safety Things

FEATURING

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The Future of Smart Security Devices

Trends and general overview of Smart Security devices

Guide for Security Camera Users and Integrators

INTRODUCTION

Security and Safety: General Overview and Trends

Looking at the trends in the area of safety and security, as they have been seen at the relevant trade fairs in recent years, a general development can be seen:

Thanks to the IoT megatrend, our world consists of more and more sensors of all kinds. Cameras in particular are playing an increasingly important role due to their extensive capabilities in processing visual data.

This starts with industrial applications and human-machine collaboration, extends to object protection and proactive counter-measures in public places, railway stations and airports, and finally also includes the analysis of purchasing behaviour in the retail sector.

The central goal here is therefore video camera systems that provide computer-aided improvement of the general security situation and can contribute to optimal human-machine communication in our society. Numerous IP-based camera systems, together with other sensors such as light barriers, heat sensors or tactile sensors, still provide more security today. These other sensors provide verification or “second opinion” — a step that will soon no longer be necessary thanks to progress in camera technology.

In this whitepaper, we present the most important developments in safety and security that will impact the visual applications market in the coming years. First, we analyze the current situation in camera technology, then present five fundamental trends and developments in the field of professional image processing systems, and finally provide an outlook on the interesting future market for safety and security technologies.

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SECURITY AND SAFETY CAMERAS

The Status Quo in Digital Camera Technology

Even though the cameras installed in our smartphones are hardly comparable with professional surveillance cameras, the large number of B2C cameras contributes to the fact that even high development costs can amortize and pay for themselves. Because even premium products, such as those found in industry, which are designed for 24/7 use, sometimes even explosion protection or all-weather operation and have predictive maintenance features, fall back on the same commercially available technical principles - although these are clearly adapted technologies.

As SoCs (System on Chips) become more and more powerful, they come with more cores and a higher clock frequency while their energy requirements remain low. On the software side, this gives developers more scope for application development. More and more cameras are equipped with an AI engine and work with a cutting-edge ARM-based multicore technology.

In addition, there are powerful GPUs that set new standards in data processing and can also process high-resolution streams. From a technical point of view, the challenge is therefore to transfer data without interruption and with high performance rather than to process such quantities of data.

No less important in the field of IP-based cameras is the software background. On the software side, in 2019 we will also be encountering Android-based devices, no longer just systems based on RTOS or Linux variants as well as Windows 10 on IoT and Windows Embedded. Android in all its varieties has established itself as a de facto standard over the years in many other industries.

The high resolution, which leads to data streams with high bandwidth, ensures that compression methods are becoming increasingly important. In particular, H.264 and H.265 have developed into powerful encoders for compressed videos. They have become a standard when it comes to efficient processing of highresolution video images. Especially when data rates are to be transmitted in full HD and beyond, an efficient codec with high compression and low-loss picture quality is crucial.

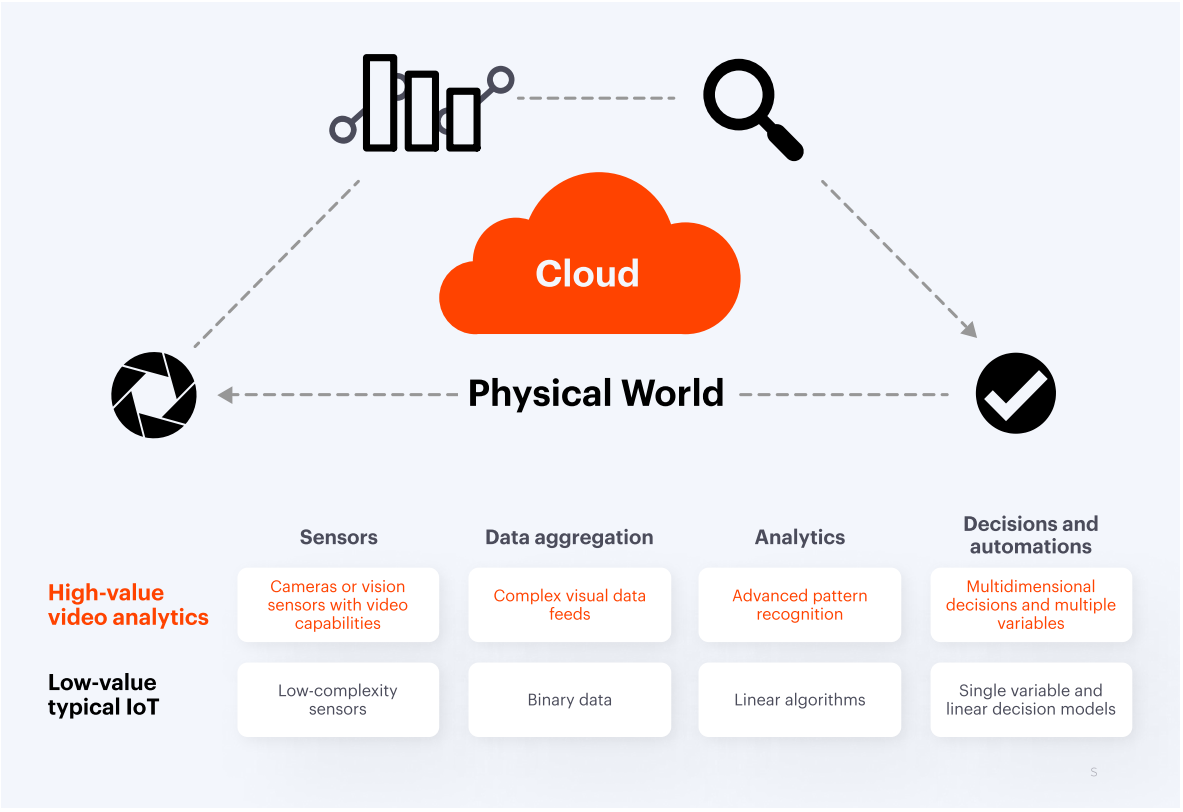
However, the operating system and the software alone, as well as the hardware, are only one aspect for an efficient overall concept. When comparing Android-based cameras, for example, it quickly becomes clear that the quality of the implementation plays an important role.

Video analytics apps provide more value compared with typical Internet of Things applications.

High quality optical sensors will only develop their full potential with appropriate software. In the future, it will therefore be a question of how hardware and software can be optimally harmonized.

With our software platform, S&ST will create an ecosystem for the camera world that makes optimum use of the computing power of the hardware in its diversity and high quality combined with an optimized operating system.

Video Analytics Compared with IoT Architecture



5 FUTURE TRENDS

5 Trends in safety and security concerning image processing technology

#1 Edge Computing

Powerful on-device intelligence is bringing more power and responsibility to the camera

Technically, there has been a paradigm shift in IT for some years now, which has led to the fact that it is no longer necessary to upload all camera video data — compressed or uncompressed — to on-premise video recording systems, video storage, or cloud-based systems. This has become possible by edge computing, i.e. decentralized data processing at the edge of the network. As a result, numerous calculations and recognition steps are carried out in the camera itself and by cooperating sensors. The resulting meta data is then specifically transferred to the cloud and merged with the data from other cameras and other sensors using the much higher computing performance available there.

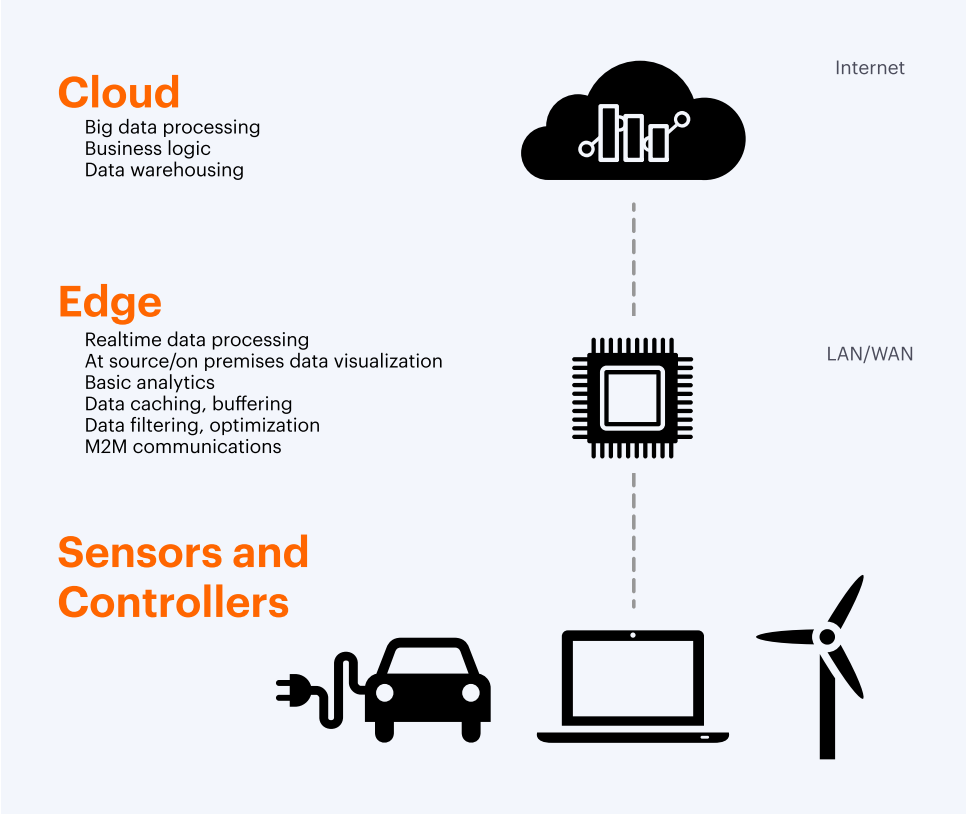
There are two reasons why even more complex calculations can take place directly in the camera: On the one hand, this is made possible by increasingly powerful hardware (see previous chapter). On the other hand, more and more functions can be and performed with the help of AI capabilities, for which the data obtained up to now had to be processed with more complex computing operations in the cloud or in a central datacenter (see Trend 2).

An example: *A camera recognizes a suspicious person and may detect a gunshot via audio detection. In this case, it is more efficient to upload and evaluate the images of the persons currently discovered on the premises checked in real time rather than permanently checking all the persons. Situational awareness will play an important role in the future, for example in combination with the evaluation of audio signals or additional motion sensors.*

Furthermore, edge computing will become even more important in image processing - and at least partially replace on premise or cloud computing managed centrally for calculations. In addition to the options on premise and cloud, there will also be different combinations of both worlds and multi/hybrid cloud solutions. In the coming years. It will therefore still be necessary to negotiate which parts of the recognition will take place on the edge and which parts will be managed centrally. The reasons for this are the higher processing speed and the selectivity of data transmission.

The volume of data streams to be transmitted is increasing even faster than the available bandwidth (especially with high-resolution video content).

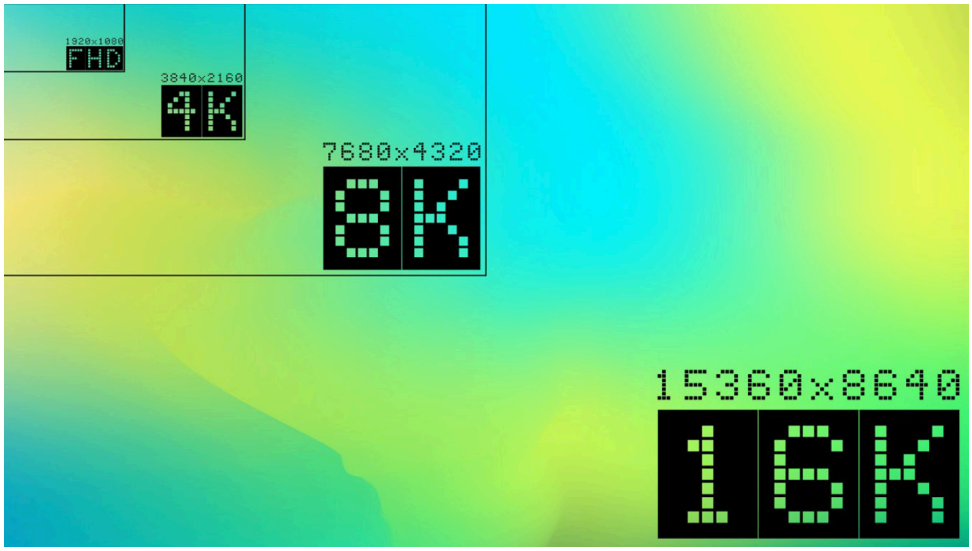
How edge computing ecosystems are organized



Running camera functionalities on the edge makes analysis faster, safer, and protects the privacy of everyone involved

16k and 8k resolution in comparison to Full-HD and Ultra-HD

Not only attractive for its entertainment purposes, videos with resolution up to 16k will be a game changer for video-based analytics.



Source info

In addition to the Full-HD (1080p) and 4K technology already available even in consumer electronics, the higher resolution of 6K and 8K is also possible and will not only find its way into the broadcast environment in the near future. After all, 8K offers 7680 x 4320 pixels — a resolution that only at first glance appears to be higher than it is necessary for industrial applications. Especially when it comes to detailed recognition (and enlarging individual details of an image), this high resolution can provide the significant difference in recognition.

This is accompanied by a constantly increasing number of images per second, especially in the area of self-propelled cars or in the safety environment of machines. While the once common 25 to 30 frames per second (fps) were the standard for a long time, 60 or even 120 fps will ensure that future technology delivers improved results, especially in the area of safety and security. But this increase in image quality and quantity goes hand in hand with an exponentially increasing amount of data. This ensures that bus systems and transmission paths become bottlenecks.

And this is precisely the reason why it will become increasingly important in the future not to transmit the entire video material, but to further process specifically extracted metadata with the help of analysis within the camera.

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#2 AI and Machine Learning

A megatrend appearing in all sectors and verticals.

An important topic that will dominate all fields of technology in the coming years is AI and machine learning in particular. This is regardless of where the evaluation and processing of the data takes place. Especially in the area of recognition and processing of image data, AI will not only be able to compare a person to others already known. AI and cameras will also be able to make statements about characteristics such as age, type or descriptive elements in comparison to other people. Companies will always have the ability to interpret safe behavior, including behavior that can only be meaningfully evaluated by humans.

An example from customer research: *The shopping behavior of a customer in a supermarket can only be insufficiently explained today by means of movement profiles. A machine-learning routine, on the other hand, can gradually accumulate a wealth of experience that only an experienced retail expert has had to date.*

An important question regarding AI, however, will be who owns the generated data. Companies for example have to negotiate which machine learning skills can be used when starting a system. In the worst case, this can mean that each system must first build up its wealth of experience.

Large digital companies such as Google with Deep Mind, Amazon with Rekognition and Facebook are working on technologies that will probably lead to astonishing quality of recognition and statement in the coming years due to their ability to learn. In particular, the open source system Tensorflow Light is suitable as a framework for equipping any IoT device with AI capabilities. Any models can be built on this.

However, this AI will only be as good as the data and evaluation criteria that the company links to it. In retail, when it comes to researching customer preferences and wishes, as well as in the logistics and transportation sector, AI can help systems to progress further in their ability not only to recognize actions, but also to assess them and draw conclusions.

An example: *In the area of human-machine collaboration, AI is already able to detect much better with the help of suitable software if the employee runs the risk of being injured and take appropriate precautions to protect him — and this without the fencing of the robot that is common for many years.*

A "Settings" Lens Helps Capture all Sources of Value

We identified nine settings where IoT creates value

Settings	Description	Examples
 **Human**	Devices attached to or inside the human body	Devices (wearables and ingestibles) to monitor and maintain human health and wellness; disease management, incresed fitness, higher productivity
 **Home**	Buildings where people live	Home controllers and security systems
 **Retail**	Spaces where consumers engage with commerce	Restaurants, banks, stores, arenas - anywhere consumers consider and buy; self-checkout, in-store offers, inventory optimization
 **Offices**	Space where knowledge workers work	Energy management and security in office buildings; improved productivity including for mobile employees
 **Factories**	Standardized production environments	Places with repetitive work routines, including hospitals and farms; operating efficiencies, optimizing equipment use and inventory
 **Worksites**	Custom production environments	Mining, oil and gas, construction; operating efficiencies, predictive maintenance, health and safety
 **Vehicles**	Systems inside moving vehicles	Vehicles including cars, trucks, ships, aircrafts and trains; condition based maintenance, usage=based design, pre-sales analytics
 **Cities**	Urban environments	Public spaces and infrastructure in urban settings; adaptative traffic control, smart meters, environmental monitoring, resource management
 **Outside**	Spaces in between urban environments (and outside other settings)	Outside uses include railroad tracks, autonomous vehicles (outside urban locations) and flight navigation; real-time routing, connected navigation, shipment tracking

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#3 5G mobile networks

Next generation will advance the processing of camera content into new dimensions

In the long term, 5G networks will become an important success factor for IoT and video processing. But although 5G is already the overshadowing subject of major trade fairs such as the Consumer Electronics Show or the Mobile World Congress, it will still be a few years before we have a nationwide network in Germany and other industrialized countries.

According to the current Gartner Report on 5G, 90 percent of the population in the USA and Canada will be able to rely on a sufficient 5G network by 2023, but in Western Europe this expansion stage is not expected until 2026. The Ericsson Mobility Report even predicts that here in 2023 only about 30 percent of customers will be able to use 5G.

Whether in the automotive sector, medicine or smart cities - 5G is becoming the basis for successful valueadded services everywhere. Especially when it comes to camera images that quickly reach a large volume of data in high-resolution quality, there is no alternative to 5G. Not only the high data transmission speeds are important, but also low latency as well as reliable and interruption-free connections, which are secure against hacker attacks in case of emergency. We will therefore see a large number of value-added services in the coming years that will be based on a reliable 5G network, for example in smart cities (e.g. parking management or traffic forecasts). In the automotive industry in particular, immense amounts of data are thus quickly collected, which also have to flow quickly and securely into central cloud services outside the metropolitan areas.

At the same time, however, there will also be application areas (especially in the field of IP-based cameras) in which 5G will play a subordinate role, at least in the coming years: for example, in the security zones of airports or in industry. This is due on the one hand to security concerns and the operators' desire for security against eavesdropping. On the other hand, however, there is a company network of its own here anyway whose logistics can also be used in the future.

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#4 IT Security

The decisive factor for the success of IoT and video applications

IoT devices will increasingly become a target for hackers and blackhats over the next few years. Reliable security technologies, especially in the camera sector, will determine how strong and sustainable the trust of users will be in IoT and image processing applications. In addition to the theft of data, this also involves the risk of preventing the functionality of IP-based cameras. A surveillance camera that does not record images at the crucial moment is the biggest likely accident for a manufacturer or operator of a public facility.

Programmers and integrators of IoT apps should therefore be clear about priorities and security guidelines as part of their security measures. In contrast to earlier years, in which malware and trojans were used to attack security infrastructure across its entire breadth, in the future individual camera types will be targeted, and in the worst case only certain cameras will be attacked. Such targeted attacks, for example based on a specific IP address space, are difficult to predict for IT security companies. Their number of cases is low and the impact can be serious.

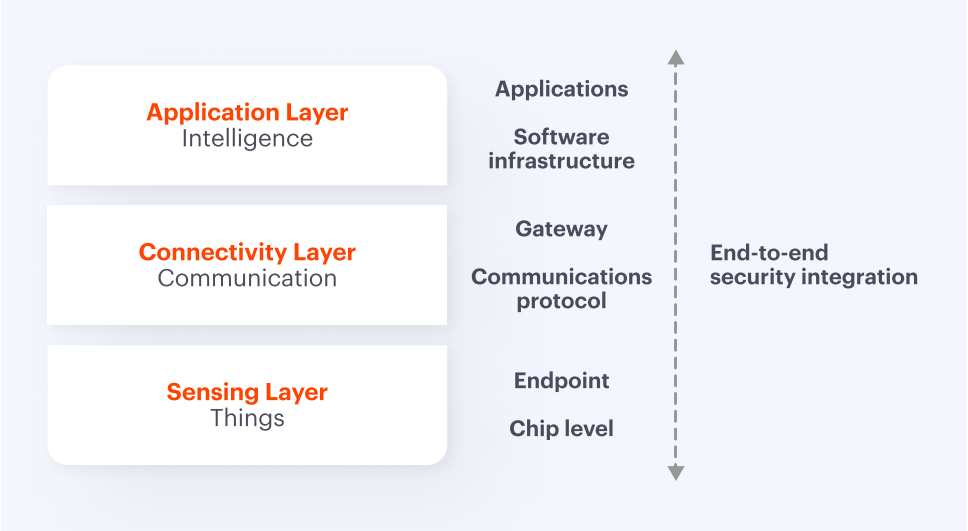
It is obvious that different security strategies are required for this than for classic corporate IT. For example, operators of IoT cameras, but also of facilities in smart cities, report on targeted DDoS attacks and ransomware attacks. Companies can use AI approaches not only to detect known malware, but also to combat unknown attack strategies. Studies by IT security companies show that the security of IoT equipment is often underestimated by project coordinators.

Unsecured IoT devices can represent a serious security vulnerability, especially for industrial facilities, but also for the infrastructure of an airport or public building. While conventional IT systems and data centers nowadays have comprehensive security, IoT devices in particular, which will

be used in large numbers in the future, often do not adequately address the security issue. In addition, the large number of different systems with comparatively small computing power should not hide the fact that security is hardly technically possible. Network segmentation can increase data security here. Different levels are created with adapted security precautions and freedoms.

Internet of Things stack

IoT security requiers an integrated concept with security solutions for each layer of the IoT stack and for cross layer threats



5 FUTURE TRENDS

#5 Camera Technology

Technical innovation from B2B and B2C create synergies for each other

In the digital camera market, there is to observe a convergence between B2B and B2C devices and the related technology. On the one hand, the smart home sector is seeing ever more powerful cameras coming from manufacturers such as Nest, Withings, Netatmo, TP-Link and Bosch Smart Home. These devices are primarily aimed at end users. Thanks to the ever more powerful and cheaper hardware components, they are increasingly suitable for more demanding applications, which were previously reserved for professional equipment only.

In some cases, image recognition with associated role assignment is also used here, for example on an Ifthis-then-that basis. For example, if certain people enter a room, other safety rules may apply than usual (e.g. notifications when the children come home to their parents).

Meanwhile, companies in the industrial safety and security sector are also producing more cost effective cameras than before, thus expanding their portfolio in the direction of home IoT. The cameras are not only suitable for recording image content, but also include, for example, sensors for motion detection or nightview sensors.

Manufacturers of equipment for professional target groups are taking advantage of the opportunity to expand and are thereby expanding their target group. They manage to make the existing know-how available to private customers and benefit from the good reputation they have acquired over the years in the context of industrial applications.

INTELLIGENT SENSORS AND SMART BUILDINGS

From smartphones to smart buildings, now is time to be intelligent

Amidst Industry 4.0, the Fourth Industrial Revolution based on the digitalization of manufacturing, the world relies on technology. From the 1990s to now, the changes are astonishing, from health to finance to entertainment. Within this whirlwind of evolution, smart technology stands out. Without it, how would our lives look like? It all happened so fast, all the enhancements in communication and commodity, that if somehow the digital world reverted, we wouldn't be able to adapt.

And, although people are evolving, there seems to be a lack of knowledge in understanding that being smart is a concept that ranges way beyond our cellphones and TVs. Our workplace can achieve higher standards of productivity, security, accessibility, management, cost, and energy-saving as well as happiness.

The rate at which technology, has been growing, is almost unimaginable. Think back to 20 years ago, there were no smartphones nor social media. Concepts such as Smart Buildings, IoT, Big Data or CMMS would be completely impossible to grasp.

How did we get to this digital world so fast? Let's revise history for a moment.

It all started in the mid to late 1700s with the First Industrial Revolution which transformed the way people lived back then. It's the revolution wherein the world became mechanical for the first time. By using water, coil, and steam as power sources for the industries, the world expanded. Besides, it was in the midst of the 18th century that Benjamin Franklin invented the lightning rod, which set the foundation for the possibility of an electrical world.

The Second Industrial Revolution was highlighted by mass production. New sources of energy were implemented such as oil, gas and, electricity which led to great inventions. First, in transportation with the automobile and the airplane. In communications were invented the telephone and the telegraph.

Besides, it was during the Second Industrial Revolution that we acknowledged the possibility of Artificial Intelligence (AI) when Alan Turing published a paper about the machinery that would be able to think. Also, it was during World War II that the first computer was created, the first data-processing machine that opened the doors for the digital world that we live on.

Then came the Digital Revolution, or the Third Industrial Revolution, which marked the era of automation and digitization. The use of electronics and computers was massive which led to the creation of the internet. The industries' growth was remarkable as global telecommunications and the automation of industrial processes enabled the creation of new business models worldwide. It was in 1990 that the first IoT device was created: a toaster that could be controlled over the Internet. It was during the Digital Revolution that Amazon, Google, and Facebook came to life.

Finally, the current era, known as Industry 4.0. A step forward in a digital world, where automation and digitalization fully settle in society and business. It all started in 2010 when sensors dropped in price allowing its use in a total diverse application. We welcomed the Industrial IoT (IIoT), IoT sensors, global connectivity, Operational Intelligence, and Big Data.

This is the era where non-renewable energy sources are finally revoked and are instead ingrained in smart technology (including smart cities and smart buildings) supplied by renewable resources: sun, wind and geothermal energy.

Now, let's focus on the technology's growth involved in making smart buildings. It all started with the building automation system (BAS), which helped in making life easier for the workers and employers, but still depended on human decisions to work and to achieve greater results. Then, facility management stood as a priority so that would improve managers' ability to make better decisions. Networking enabled insight and then fault detection and diagnostics (FDD) systems helped in maintenance management. Also, with smart technology gaining ground in all businesses, operators won't need to worry about maintenance on a set schedule. Smart buildings' control improves maintenance management by a large since it will be data-based, and every time a malfunction is detected, operators will

be informed on what and when to do certain tasks. This also will help with productivity and optimal functioning of management since operators will be focused on higher-value tasks.

The skyline of Dubai at night. The technology that makes Smart Buildings possible would be inconceivable twenty years ago.

For these ideas to work, there is maintenance management software that enterprises use to boost their efficiency and to avoid faults in any of its core systems. Nowadays, it's recommendable to implement CMMS software on all companies. CMMS stands for Computerized Maintenance Management System, which is a software that stores all data related to maintenance management processes. With it, CMMS can help operators and managers in improving all operations.

INDUSTRY 4.0

#1 Operational Intelligence

One of the main concepts of Industry 4.0 is Operational Intelligence. But what is it?

It's a system that relies on data analytics to provide help in decision-making and problem-solving based on real-time data, which helps businesses grow and become optimal.

Generated data is one of the most complex and important fields of Big Data. Its value relies on all the records that are stored within the data, which include your user transactions, security threats, your customer and systems behavior, etc.

Operational Intelligence enables proficient systems to work. An example of its utility is maintenance. As mentioned before, CMMS is a tool needed in today's world to evolve your maintenance management processes into data-driven real-time tracking of operations that relieves your workers from unnecessary tasks. All it's possible thanks to Operational Intelligence.

#2 IoT Sensors

The most important devices that are used by IoT softwares to understand the envinronment around.

First of all, sensors are devices that identify changes in a certain environment. It provides a measurement of physical proprieties depending on the sensor, such as temperature, pressure, motion, light, etc. It's of common use and can be seen everywhere, in our homes, smartphones, and workplaces.

As we dove in the Industry 4.0, sensors' value rose greatly, as its cost reduced and Internet of Things appeared. From that moment, a concept was born: IoT Sensors.

Sensors' application and adoption became more versatile and valuable with the introduction of global connectivity in all devices made possible with IoT technology.

Its utility in manufacturing can be complex and diverse as is a tool that can be applied in all systems within an enterprise. But how are they helpful?

IoT Sensors can grant automation, connectivity, data collection, analytics and optimization of workflows. Which, by connecting all devices and being able to give a real-time analysis of all data generated, improve productivity. Facility management and maintenance management (with the use of CMMS software) are also enhanced greatly.

#3 Smart Buildings

Finally, what all this innovation leads up to.

With the advancements of technology, society is becoming smarter and smarter, so it's expected that the buildings follow that path. The concept is called Smart Buildings. What is based on this idea?

Smart Buildings avoid the methods of traditional buildings by using IoT technology to automate and optimize all systems working on enterprises, homes, hospitals, etc. The wireless connectivity between all devices that IoT allows turning all buildings into smart ones. Once its concept is completely applied, each person will be able to attain a greater level of comfort and productivity. Facility management and maintenance management will be facilitated by CMMs software, which is possible thanks to IoT technology and Big Data.

In this new world of Industry 4.0, all is connected which enables the possibility of Smart Buildings to come true.

INTELLIGENT SENSORS AND SMART BUILDINGS

Conclusion

As technology exponentially evolves, new concepts arrive every day to helps us improve our quality of life. The main idea of Industry 4.0 relies on Big Data and IoT sensors to enable life-changing processes that help workers and employers in maximizing their job, by automation and optimization across all business. Facility management and maintenance management are enhanced by CMMS, which allows cost and time-saving in all fields. Data are generated at an absurd scale and with it, its management is crucial for companies to attain efficiency and optimal performances.

Ideas such as Smart Buildings are within the realm of possibility because of this technological growth. Assets are being maximized and with-it costs are reduced, workers are happier with less work and more efficiency.

Besides, energy-wise, Industry 4.0 will greatly help our environment, since this technology will be focused on green energy, which means that environmentally our planet welcomes with open arms this new way of life.

LOOKING AHEAD

Outlook: impressive market potential and good opportunities for IoT applications in the image processing sector

Deloitte forecasts that the German market for IoT applications alone in the B2B sector will reach a volume of around 50 billion euros by 2020. And although there are no concrete figures for the safety and security sector or even for the subset of camera-supported security applications, one thing is clear:

We find a market here that promises extremely interesting sales potential and opens up immense opportunities thanks to an app platform to be created.

The processing of visual data can create great added value for security applications, for example in retail, in industry 4.0 in smart cities and in public spaces.

S&ST plans to build a software-based, globally available ecosystem for the development of IoT applications in the booming field of security cameras. The S&ST operating system will go live in the course of the year and be framed by a platform that offers a secure and scalable marketplace for security and safety apps, also being used for “beyond security” scenarios / Business Intelligence use-cases.

SOURCES

Expert interviews, McKinsey Global Institue Analysis

McKinsey Global Institue Analysis

ventusud / epositphotos.com

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About us

At Security and Safety Things, we assist developers in creating applications for IoT in the fields of security and “operations” and in monetizing globally through our digital marketplace, all on the basis of an open and standardized development platform.

Security and Safety Things is a fully owned but independent Bosch start-up head-quartered in Munich, Germany.

Our Platform

Security and Safety Things is designing a global ecosystem for security camera applications.

This open and secure IoT platform will be launched in 2020, establishing a new industry standard based on an open OS and API, an app store, and an integrator portal. This is the foundation our industry has been waiting for so we can build on the power of the IoT.

For more detailed information on S&ST, please visit:
www.securityandsafetythings.com

About Infraspeak

The platform for asset management, audits and maintenance used by over 40,000 teams, every day. Innovative Maintenance & Facility management solution for better decisions and intelligent operations.

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Their Solution

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For more detailed information on Infraspeak, please visit:
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