SIEMENS

Background information

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Digitalization lays the cornerstone for the future

Siemens' "Technology" department is the company's central research and development (R&D) unit. Worldwide, the roughly 2,100 employees at Technology collaborate with the Siemens Business Units in their work on the fundamental technologies of tomorrow that are important for the entire company. As a strategic partner, Technology also protects Siemens' intellectual property and coordinates the company's collaboration with top universities. One of the total of 16 key partnerships that Siemens maintains with universities is with the Technical University of Munich (TUM). Siemens has been cooperating closely with TUM for more than 20 years.

This collaboration and the joint R&D work at the new Siemens Technology Center in Garching, Germany, focus on a variety of future-oriented digitalization topics that are important for Siemens, the Siemens "Core Technologies."

"Simulation and Digital Twin"

Today, the digital twins of industrial products and systems are mainly employed in development work and manufacturing. However, they are also used to optimize complex systems, such as those used in transportation and environmental technology as well as urban development. In the operational phase of machines and plants, these twins make it possible to analyze operational states and then use this analysis to prevent, or quickly resolve, system failures.

Simulations performed using digital twins help optimize products and systems. As a result, this technology has considerable potential for more efficiently developing, manufacturing, building and operating industrial products and production systems, but also entire infrastructure systems, such as power grids.

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“Industrial Internet of Things”

In the industrial internet of things (IIoT), industrial goods are equipped with connectivity features and suitable sensors and actuators in order to monitor – and, where appropriate, change – their operating states. In addition, industrial plants are increasingly being equipped with their own computational capacity so that the data they generate can be processed on site. The data processed in this “edge computing” can then be used to make decisions and, if necessary, implement those decisions at once.

These capabilities create completely new possibilities for enabling the companies that build or run industrial plants to design the plants and optimize them throughout their lifecycle – and do so in combination with new business models, such as pay-per-use operation of plants. Considerable research is needed in this area, for example with regard to integrating different sensors into complex sensor networks, fusion of sensor data, continuing the development of perception technologies and integrating those capabilities into industrial processes – also with the aid of the new 5G cellular network standard.

“Future of Automation”

The term “Industry 4.0” refers to the worldwide revolution currently taking place in areas such as the manufacturing industries as a result of the new possibilities enabled by the digital transformation. Combining digitalization, automation and artificial intelligence provides a way to make manufacturing facilities increasingly flexible – and thus more productive.

In addition, new technologies make it possible to automatically derive the required manufacturing steps from the product that is to be produced, compare these steps with available manufacturing capacities, and then create the required production process almost automatically. In this way, future manufacturing operations will be able to react flexibly to dynamic changes in demand. However, before this vision can be realized, considerable research still needs to be done in areas ranging from the continued development of robotic systems to the development of autonomous production functions and all the way to automatically deriving manufacturing steps from product models.

“Additive Manufacturing Processes and Materials”

Additive manufacturing processes are increasingly taking over parts of the methods used to manufacture prototypes, individual parts, small batches, and spare parts. The focus here is on developing new 3D-printing processes and hybrid approaches by combining

additive and subtractive manufacturing with casting processes. The biggest challenges? Increasing robustness while also boosting productivity.
By acquiring comprehensive data and then using that data as the basis for simulating materials and processes, digitalization provides support that begins in the design phase and continues all the way to production and quality assurance. In this way, it is possible to ensure that a product designed on a computer can be printed in the real world in a way that is efficient, environmentally friendly and uncomplicated. At the same time, data and data analysis can enhance traditional manufacturing, for example by improving the predictability, accuracy and flexibility of production steps – in particular, through increased use of robot-based handling and automation systems.

“Power Electronics”

Power electronics convert, switch and control electric power efficiently wherever electricity is generated, transmitted, distributed or consumed. New applications, such as renewable sources of electricity, electric vehicles and e-charging, battery storage, direct-current infrastructure, and autonomous robots, are the mass markets for industrial power electronics. In many cases, the requirements for performance, functionality, sustainability, serviceability, costs, installation space and weight are rising continuously while innovation cycles are becoming shorter. In addition, power electronics serve as a data-access and control point for the internet of things (IoT) as well as in the industrial IoT and the internet of energy, which have been derived from the internet of things. Siemens is at the forefront in the transition to a digitalized, converter-centric power infrastructure, which comprises grid and building infrastructure, industrial environments and private residences.

“User Experience”

Users expect it to be easy to interact with devices. How do customers use products? What features do they need? And more importantly, what features are redundant and can be eliminated? As a Siemens Core Technology, User Experience focuses on users, their expectations and the way that they interact with our products. We want to get to know the users better to understand their needs, preferences, strengths and limitations.
The experiences that customers have with products or services are becoming the key differentiator. Investing in the user experience is also important for identifying the key target areas and opportunities for every solution, service and product.

“Software Systems and Processes”

The purpose of the Siemens Core Technology called Software Systems Processes is to master the digital transformation on a large scale by focusing on performing research and predevelopment work and on transferring innovative software technology.
To make this happen, Siemens aims to hold a leading position in the shaping of digitalization software for facility management, automation systems, power plants and signaling centers. This Core Technology uses innovative software technology to support and accelerate the digital transformation of the company and its portfolio of solutions. The select team of software experts is tasked with exploring and building tools and methods for developing the required digitalization software.

Successful past – Ready for the future

Siemens’ Technology department in Munich can look back on a particularly long and successful past. As far back as the early 1990s, the department was – in keeping with the motto “computers are becoming thinkers” – already developing initial computer systems that mimicked the thought structures of the human brain and used those structures to perform tasks such as image analysis in industrial applications. Advanced exhaust-gas sensors that today are standard in any automotive catalytic converter came to life here in 1991. As did a device that back in 1992 was referred to as a “telephone with an integrated interpreter” and could automatically recognize and translate different languages. Other inventions included a gesture-based computer controller (1993), initial robots that used ultrasound systems for orientation (1993), the switches needed for transmitting large amounts of data in fiberglass networks (1994) and the world’s first sensors without their own supply of power (2000). This list, which could go on and on, impressively demonstrates that innovations developed by Siemens in Munich have already lastingly changed the world for the better. With the unit’s focus on digitalization, these innovations will also continue to have this influence in the future from the new Siemens Technology Center in Garching.

This background information as well as the corresponding press release and press images are available at https://sie.ag/topping-out-ceremony-future-research.

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Siemens AG (Berlin and Munich) is a technology company focused on industry, infrastructure, transport, and healthcare. From more resource-efficient factories, resilient supply chains, and smarter buildings and grids, to cleaner and more comfortable transportation as well as advanced healthcare, the company creates technology with purpose adding real value for customers. By combining the real and the digital worlds, Siemens empowers its customers to transform their industries and markets, helping them to transform the everyday for billions of people. Siemens also owns a majority stake in the publicly listed company Siemens Healthineers, a globally leading medical technology provider shaping the future of healthcare. In addition, Siemens holds a minority stake in Siemens Energy, a global leader in the transmission and generation of electrical power. In fiscal 2021, which ended on September 30, 2021, the Siemens Group generated revenue of €62.3 billion and net income of €6.7 billion. As of September 30, 2021, the company had around 303,000 employees worldwide. Further information is available on the Internet at www.siemens.com.