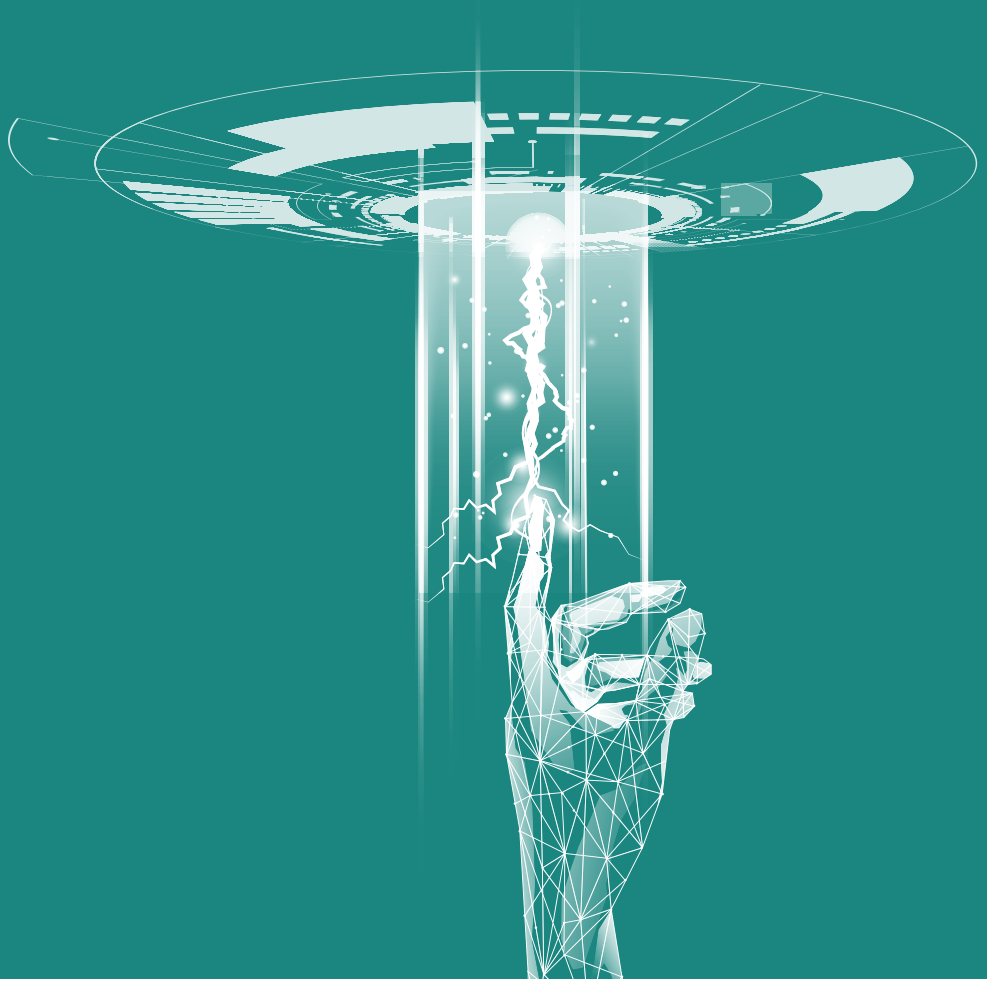
BOSCH
Invented for life

A 7 Step Digital Approach
for Transforming Product Engineering



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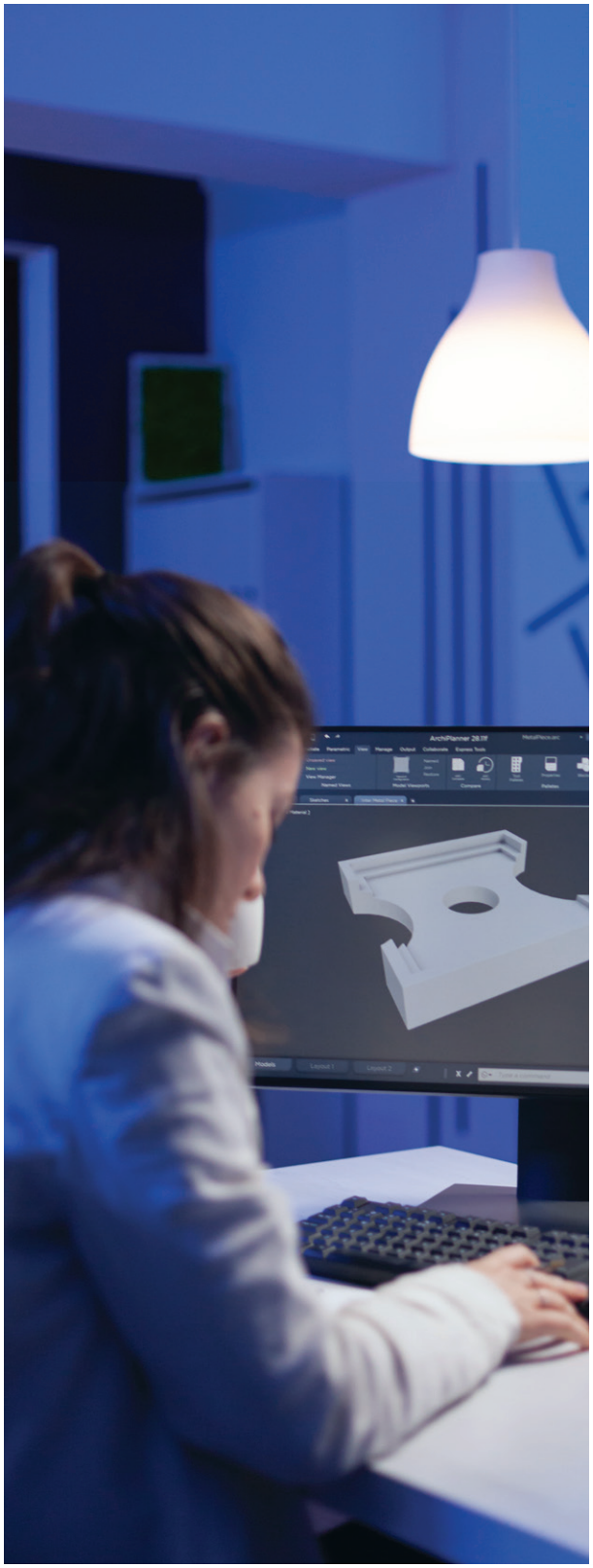


DIGITAL ENGINEERING SOLUTIONS FOR SIMPLIFIED PRODUCT DEVELOPMENT

Digital Engineering is the way!

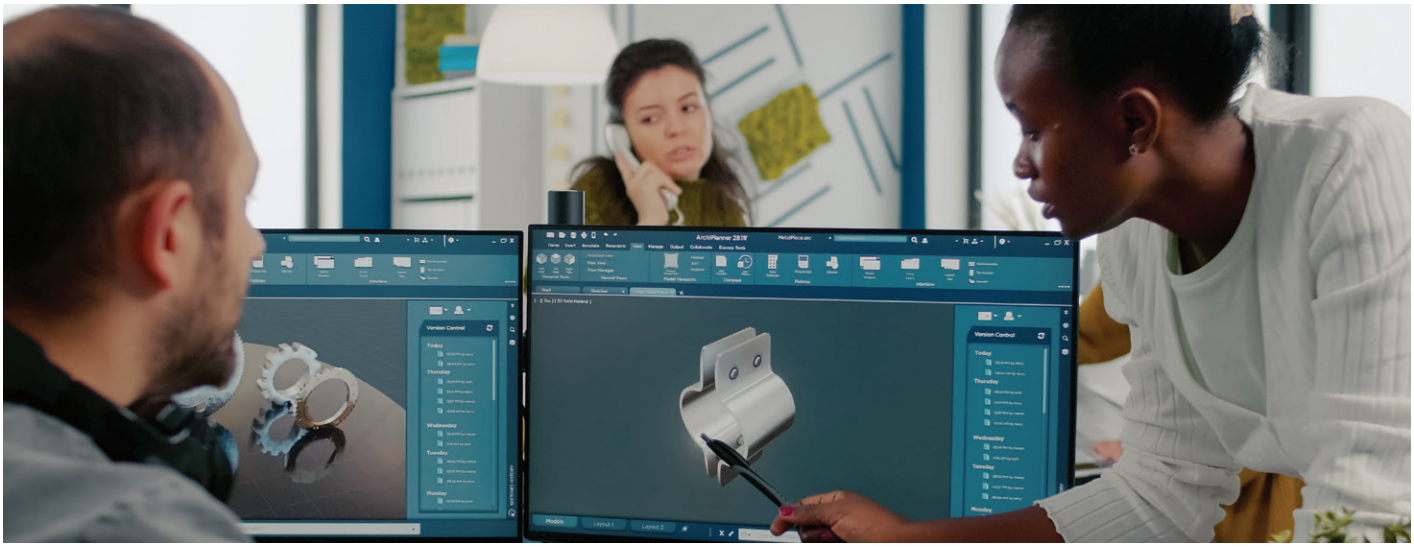
The emergence of new technologies has disrupted the way we live today, in a connected and competitive world. Technologies that seem 'latest' today may become outdated tomorrow. Faster and more efficient tools will change the way we design and deliver projects.

This is why a Chief Product Officer (CPO) of any organization needs to be a visionary, a supervisor and the chief custodian of the product. As more and more products become digital, the new-age CPO has several novel challenges to address. So, how do CPOs and organizations keep pace with the lightning speed of the technological evolution? This is where digital engineering comes into the picture.

Digital Engineering fuses the art of design with the science of data, by integrating technology with traditional engineering practices.

When adopted at the formative stages of any project, Digital Engineering enables better design and helps identify and tackle risks that might create problems at later stages when modifications become effortful, expensive, and time-consuming. Digital Engineering facilitates higher predictability, better pricing, faster time-to-market and enhanced performance.

But how do you really go about digital engineering your products? How does it start and where does it end? Often, Digital Engineering is used as an umbrella term encompassing several technologies that work in tandem with each other to deliver the desired solution. This paper highlights transformative technologies and frameworks that encourages and facilitates movement from traditional product development to digitally engineered product development.



TRADITIONAL PRODUCT ENGINEERING

Phases

Traditional product engineering is sequential in nature with one phase feeding into another. Being a fairly simplistic process, this framework used to provide a good foundation for product development. However, today, it poses some sizable challenges with most of the processes being manual, error-prone and time-consuming.

As product complexity increases, the stakes at each stage become high.

Challenges

While CPOs have been using the mentioned phases of product development for decades and have achieved success, they face several challenges in the journey. Some of these challenges include:

Product Evolution

As technology and customer needs evolve, there is a need for a more dynamic setup. The traditional framework leaves little room for alterations during developmental stages which could impact the relevance of the solution and cause wastage.

System Migration

Migration from traditional systems to new ones poses a serious challenge to organisation. Important and beneficial data sometimes get lost in the processes, adversely impacting the product ecosystem during and after the transition.

Compliance

It is important that a product aligns with regional compliance regulations while minimising environmental hazards. This makes it essential for organisations to keep track of all regulatory needs and compliance, which can prove to be very challenging.

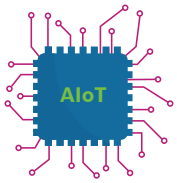
Security

One of the biggest challenges of the digital world is data and model thefts, which result in huge losses - in terms of revenues, credibility, customer loyalty and more. Ensuring customers of their security through one's products is of key importance today.

PRODUCT DEVELOPMENT THROUGH DIGITAL ENGINEERING

Transformative Technologies in Digital Engineering

The aforementioned challenges pose a pressing need for enhancements in traditional ways of product engineering. Developing products for the next generation involves increasing the functionality, adaptability and security of the product experience. In order to do so, several technologies have come to the forefront and will soon become ubiquitous in product development setups.



AIoT

Earlier thought of as two independent technologies, the fusion of AI and IoT is set to define new benchmarks for connected products, connected machines and connected systems. By considering long-term applications of the product, engineers can map out product experience and security aspects relevant for the future.

Edge Compute

Today, the product development process involves data collection from multiple sources. Edge computing makes it possible to analyse data in real-time, right at the point of collection. It enables fast processing of raw data for applications where very quick actions are required.

Virtualization

Virtualization allows us to build multiple simulated environments from physical hardware systems. From network functions to server to OS virtualization - the applications are many. It allows organizations to optimize costs by pooling their resources, migrating legacy setups and collective maintenance from a single source.

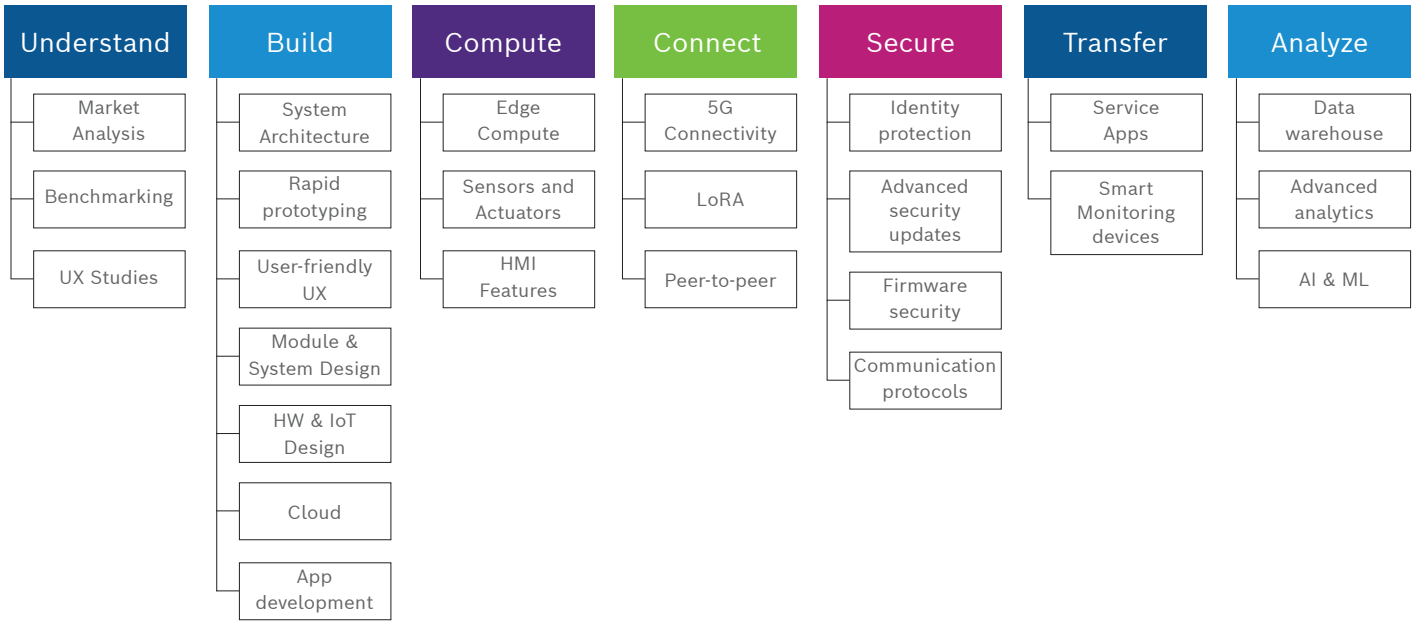
DevOps

DevOps plays a key role in product and application lifecycle management. A DevOps driven environment commits towards thoroughly and frequently optimizing processes, automating workflows, integrating data and testing systems.

Bosch Digital Product Engineering Grid

Organizations talk a lot about these transformative technologies, but the need of the hour is to apply them to solve critical business problems.

Bosch Dig Prod Engg (DPE) Grid provides a 7-step approach to enable CPOs develop new-age digital products and overcome the challenges in traditional product engineering. Not only does the grid help evolve your current business landscape but also helps open up opportunities for creating new business models by leveraging advanced technologies. The DPE is designed to build smart, secure, modern products for the modern-day consumer.



Bosch DPE Grid - A 7 Step Approach For Transforming Product Engineering

Understand

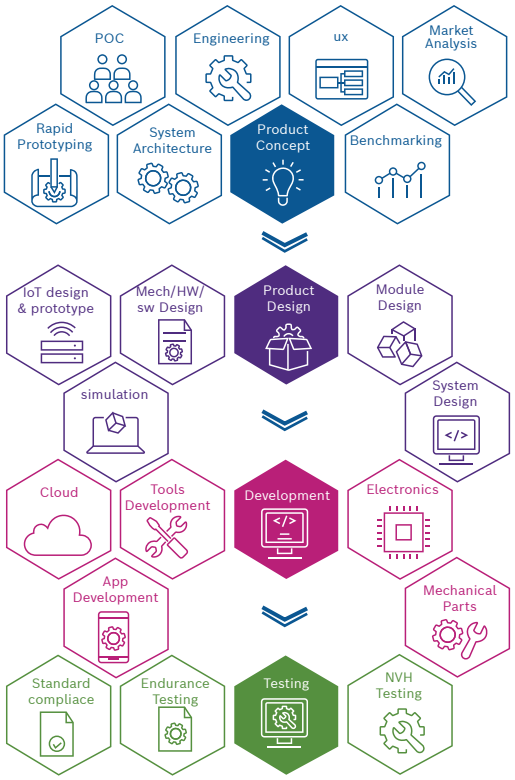
Understanding Customer Pain Points and Requirements

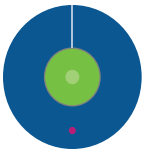
Before jumping into product development, Bosch DPE Grid makes use of market analysis, benchmarking and UX studies to understand the actual pain points or needs of the customers.

Build

Physical Product Development

The build stage encompasses product conceptualization, design, development and testing. DPE Grid makes use of rapid prototyping, hardware, software, module & system designing using various simulation tools. This strengthens the product in the conceptualization and design phases, even before proceeding to actual development, which is then followed by a robust and exhaustive testing process.

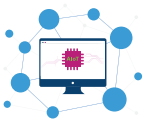




Compute

Smart Sensor On-Board Compute

From devices monitoring manufacturing equipment to cameras sharing live footage, about a quintillion of data is generated from IoT devices every day. Bosch DPE encourages the use of edge computing that allows you to pre-process data on the device itself. Sensors and actuators on devices help create better, more efficient human-machine interfaces. As we move towards compute-on-chip, features such as facial recognition, voice commands and biometrics become faster, accurate and convenient for the end-user.



Connect

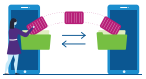
Modern connectivity

Today's digital smart products should also be able to integrate and be compatible with third-party applications, for which modern connectivity is imperative. These technologies including 5G, LoRA and peer to peer, can ensure a smooth and hassle -free user experience. Specialized interoperability solutions including thorough connectivity testing at this stage, will give an added advantage in improving customer experience.

Secure

Product Security

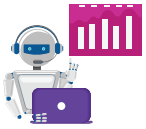
Modern products also make the systems prone to vulnerabilities, such as breaches, data manipulation and product tampering. Digitally engineered products can improve a user's experience of safety, adaptability and reliability. Bosch DPE Grid lays a comprehensive vision for device, firmware, communication, cloud and lifecycle security. It includes trust in every layer starting from identity, boots, updates to operations.



Transfer

Data Transfer to Smart Apps

For a convenient user experience, the data collected through sensors and actuators is transferred to service apps and smart monitoring devices. These apps can be accessed through mobile devices or using web services allowing information transfer, remote management and on-click decision making.



Analyze

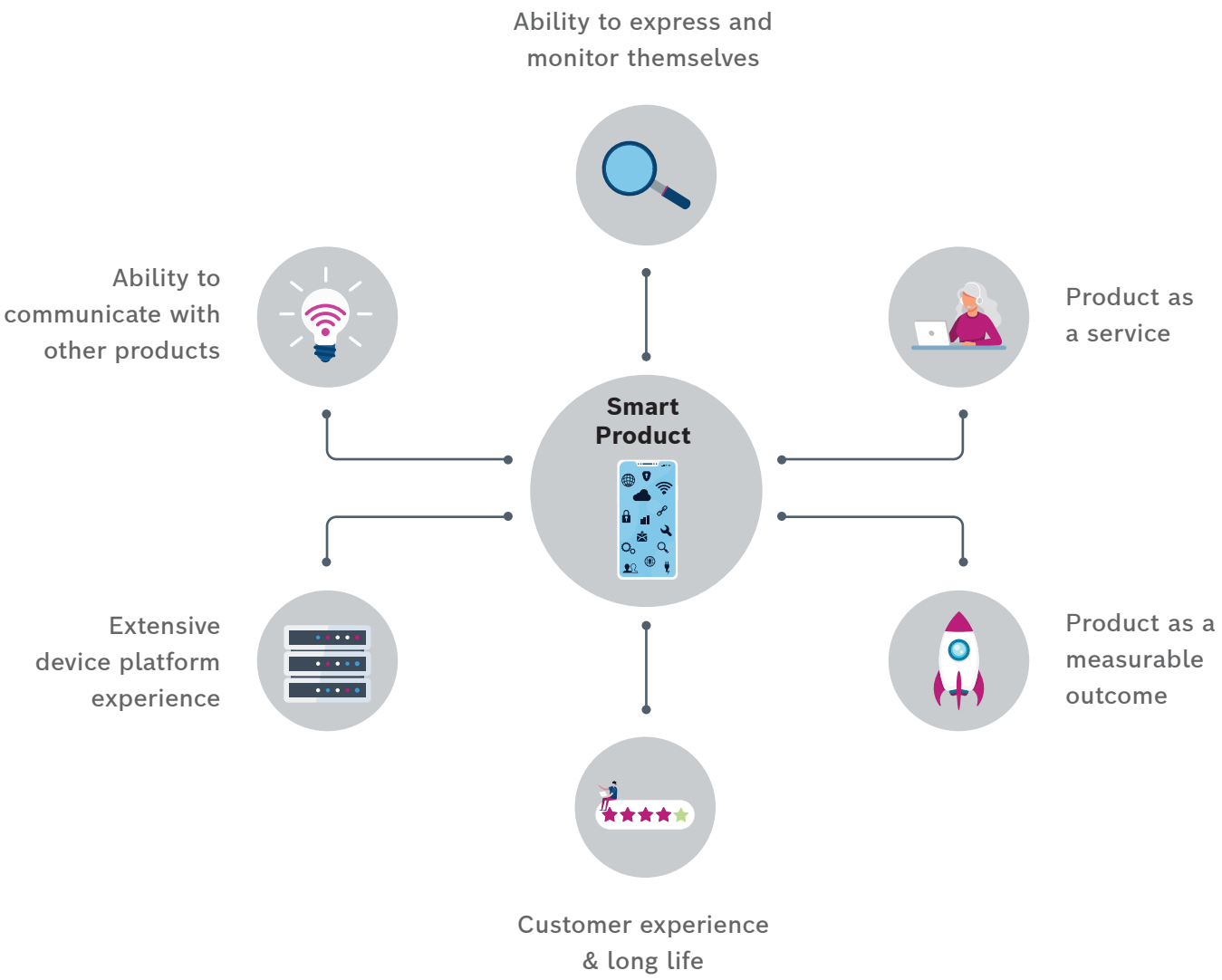
Analytics & AI

Bosch DPE enables the products to be connected and collects data continuously by interacting with customers. This data can be combined with advanced analytics to develop useful insights about usage, performance as well as market segmentation and designing future products. It also helps the connected products to adapt to changes, evolve continuously and become even more intelligent with time.

Benefits of Bosch DPE Grid

Bosch DPE Grid solves most of the burning challenges faced by product heads from around the world. These solutions are not only useful in the present but will stay relevant for years to come. Here's how a Bosch DPE enabled future-ready product, makes a CPOs life easier:

Future Ready Products



Ability to Express and Monitor

Future-ready products will have the ability to predict their own failures. Monitoring allows businesses to track a product's operating characteristics and history. It also helps them to understand how an end customer uses a product. Monitoring data may also reveal warranty compliance issues as well as new sales opportunities.

Hassle-Free Product-to-Product Communication

Many businesses are starting to look into cross-platform communications. Businesses are now transitioning between devices. Bosch DPE offers device-to-device communication across platforms, which is a must-have and without which businesses cannot survive in today's world.

Extensive Device Platform Experience

It has become important for smart products to make a paradigm shift towards building orchestrated experiences across all the channels and devices available throughout the customer journey. Bosch DPE can attract, engage, and delight target customers using an integrated set of technologies to give an extensive device platform experience.

Product as a Measurable Outcome

With Bosch DPE, products can function with complete autonomy, applying algorithms that utilize data about their performance and their environment. They can also include the activity of other products in the system by leveraging their ability to communicate with other products. Thus, the product itself becomes capable of having a measurable outcome.

Lifecycle Management through Product as a Service (PaaS) Model

PaaS provides application lifecycle management features as well as specific features to fit a company's product development methodologies. Bosch DPE can be used to reduce an application's time to market, by automating or completely eliminating housekeeping and maintenance tasks.

Enrich Customer Experience

Bosch DPE enabled smart products allows companies to develop much closer customer relationships. By capturing rich historical and product-usage data, companies can provide customers with a very enriching experience, at the same time increasing buyers' switching costs. Smarter products also have longer life due to early problem prediction and timely maintenance.

THE NEXT-GEN CLOUD-BASED LAWNMOWER

Bosch managed to transform a traditional lawnmower into a digital smart mower by implementing its proprietary DPE framework. A simple machine such as a lawn mower can be laden with several problems and could involve tedious manual tasks. The new product had to be designed from the end-user perspective by identifying different painpoints and addressing them comprehensively. The objective of creating a smart mower was to make the entire process of lawn mowing automated and efficient while requiring minimal manual intervention.

An automated mower, however, can present its own challenges. The team at Bosch identified several issues that a smart mower must be able to address before it can be launched in the market. Guiding a lawnmower on a particular path while ensuring it does not collide with unintended objects is one such issue. Built-in gyrometer, compass, accelerometer, and inclinometer were made to work in tandem with each other to help guide the mower on different plains. The mower was also equipped with sensor-driven obstruction detection technology, which allows it to function with little to no manual support.

Bosch DPE places emphasis on user-experience as a central theme throughout product design. The team needed to ensure that the product can communicate with the user with ease. The human machine interface hence needed to be simple and convenient to use. With voice command integration and specialized product app for user notifications, the product becomes more than just a mowing device. Additionally, the lawnmower is also capable of automatic charging and uses battery analytics and odometrical sensor data to send predictive alerts thus helping the customer with predictive maintenance and after-sales support. As is evident, Bosch Digital Product Engineering focusses on the entire product lifecycle and user experience leading to organic innovation, better customer experience and market breakthroughs.

The Smart Lawn Mower

Sensors

- Bosch Inclinometer, gyroscope, Accelerometer, compass
- Wheel Encoders
- Wireless loop sensor
- Current sensing (multiple points)

Software

- Control software for navigation
- Safety software
- Real time connectivity and data management

Services

- Cloud Connectivity for governance and maintenance
- Inertial navigation System
- Obstruction Detection Techology Designed and Deployed
- Product design and Development

DIGITALLY ENGINEER PRODUCTS WITH THE RIGHT DIGITAL PARTNER

A digital renovation is now compelling organizations to hold a new lens towards product development. They need to employ new measures to allow their product development systems to meet the growing expectations of the customers. The future ecosystem is one of increased connectivity and innovative solution-focused thinking. Products of the future have the ability to not just analyse their operations but also communicate them in real-time. This calls for organisations to make room to revamp their product development processes to match up with innovative and fast-paced operations of the digital markets.

Bosch is a torchbearer for all organizations that are looking forward to transforming themselves digitally. With its continuous focus on innovation, Bosch DPE brings together an amalgamation of some of the most relevant technologies in the context of today and tomorrow, to help you stay ahead of the curve. Digital Engineering can empower companies to advance beyond the traditional industry systems and implement solutions that are intelligent, effective and show continuous improvement. Companies should be at the forefront of this change with a partner that understands not just technology, but also your business motive and imperative. With Bosch's extensive expertise across technology verticals and in-house development facilities, Bosch DPE uses an agile approach for high-quality product engineering providing a hassle-free experience, faster time-to-market and better revenue-generating opportunities.

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The author has significantly contributed to the digital transformation journey of Bosch and several Fortune 500 companies across geographies. An expert in designing AIoT solutions, Nihal helps organizations build robust roadmaps for digital product engineering.

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