



BOSCH

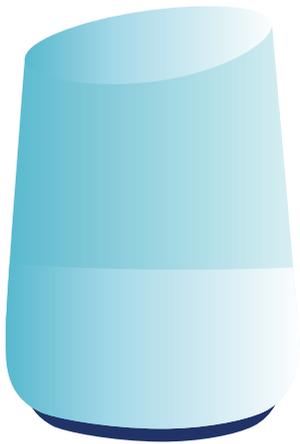
Invented for life

Innovating for

Faster Time-to-Value



Our lives seem to be getting simpler with the introduction of every new smart device.



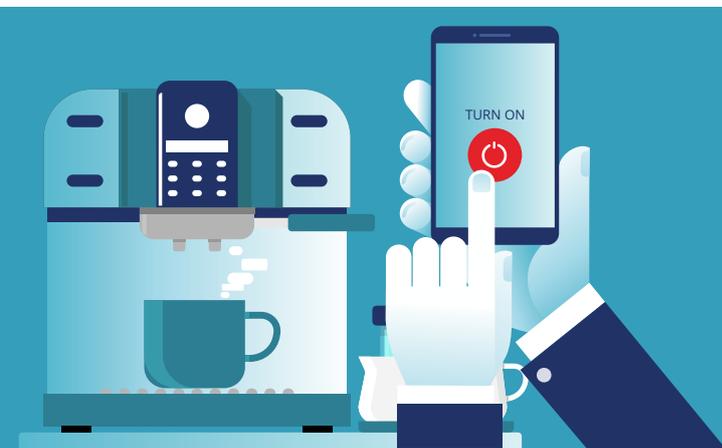
At Home



During Commute



At Work



Today, we have robotic vacuum cleaners and lawnmowers which perform chores that once kept humans occupied for hours. Smart, connected devices in the kitchen provide all the help you need to prepare a sumptuous meal. These devices have sensors that collect data and send it to the cloud for analysis. You can speak to some of these devices and they will respond. Some even keep a watchful eye on your home and are aware of your environment.

You will read more about these devices in this whitepaper but be informed- they are not science fiction. Today, they are a reality, either in production or as working prototypes. While we marvel at their functionality and the convenience they offer, we rarely see or acknowledge the technologies and the superior Industrial Design Engineering under the hood.

This whitepaper takes you behind the scenes to show you the engineering expertise and competencies needed to turn an idea into an industrialized product.

Smart Technologies

A combination of cutting-edge technologies is packed into the modern connected device. Engineering teams have exploited the Internet of Things (IoT), Natural Language Processing (NLP), biometrics, and more. Various components such as sensors, thermostats, gyroscopes, cameras, biometric units, actuators, and plenty of technical paraphernalia are engineered to work in an integrated and seamless manner.

To achieve this, teams with diverse skills like



UI/UX



Industrial Design Engineering (IDE)



Cloud



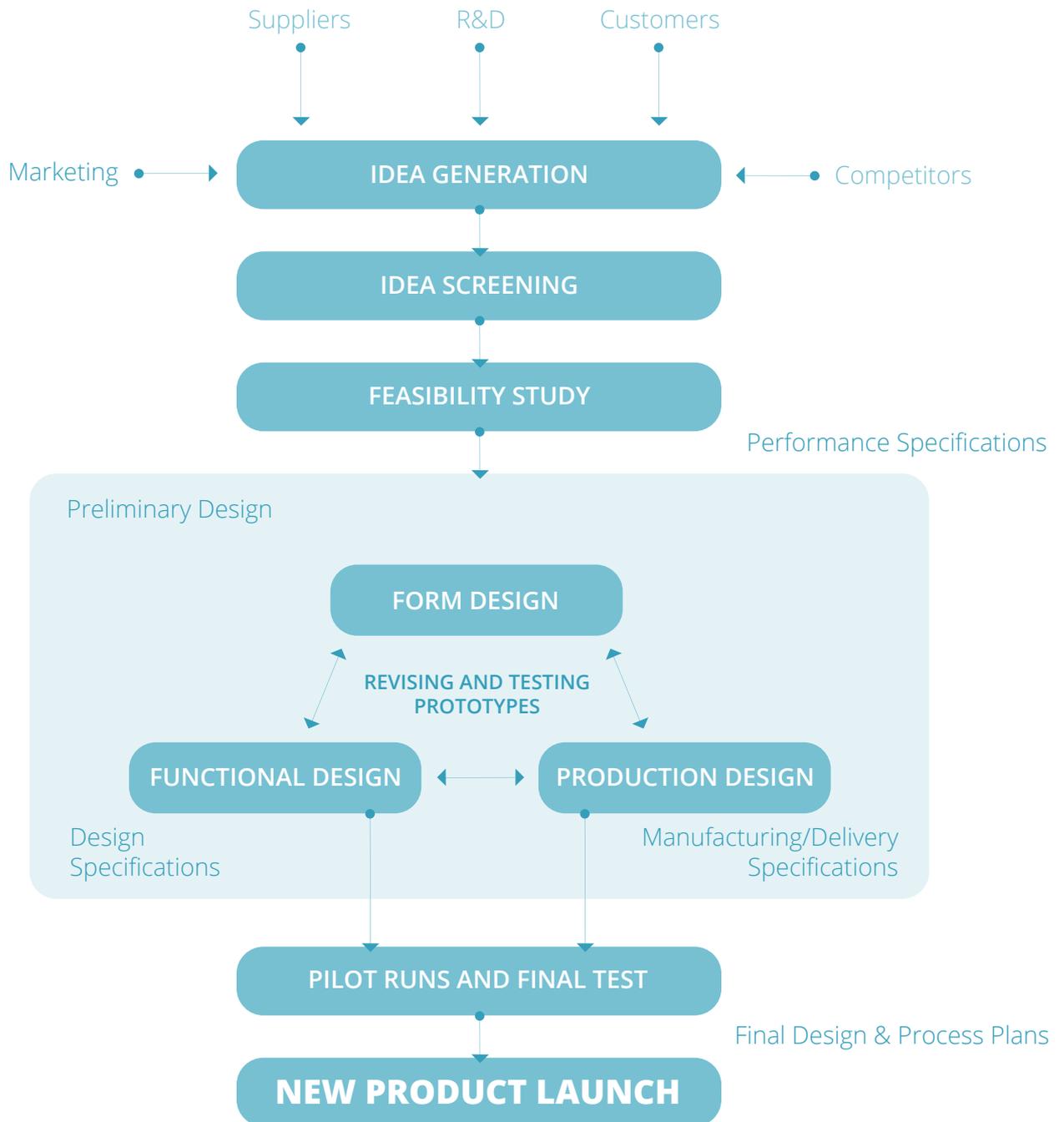
IoT

collaborate and work in a carefully coordinated manner. Product prototypes undergo hours of testing in harsh environmental conditions to ensure compliance with industry standards.

But how do all these teams work together to bring these products to life?

The manufacturing industry follows a specific set of processes to take an idea and bring it to industrialization and mass production.





Bosch uses Design Thinking

At every stage of the product life-cycle, from manufacturing to testing to compliance, Bosch engineers look to reduce design cycle time and cost of engineering. Bosch engineers always strive to develop a state-of-the-art product which is both reliable and cost-effective. To do this, the design team uses processes like DRBFM (Design Review Based on Failure Mode), FMEA (Failure Mode and Effects Analysis), and DFMEA (Design Failure Mode and Effect Analysis). To get the best out of digitalization and IoT, while ensuring security, the design ecosystem used by Bosch has considerations of service, remote monitoring, and cloud connectivity.

With you from Ideation to Industrialization

Bosch guides you through a 5-step process for the creation of a safe and reliable IoT product.



Step 1: Ideation



It begins with **brainstorming** - An idea for a new product emerges from a discussion carried out internally or involving the customer.

The product engineering and development teams take ideas and create **wish lists** for new products and their features.

A product idea is then **benchmarked** with similar or competing products in the market and the results are used as inputs for creating new products.

The Bosch Difference

Bosch uses predefined processes for ideation with Innovation Gates 1-2-3 of the State Gate model that serve as decision points post preliminary analysis, definition, and concept development, respectively.



Step 2: End-user challenge



The product development team may talk to customers or conduct closed group discussions to uncover [customer challenges](#) and pain points.

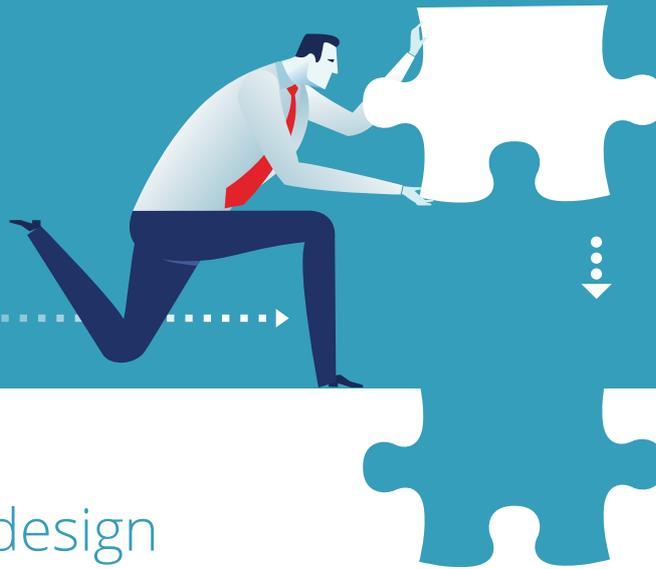
Accordingly, a [feasibility study](#) may be conducted to test the possibility of converting the selected idea into a real product.

The idea conceptualized is [analyzed technically, economically, and strategically](#), to assess whether the envisioned product is feasible for development.



Feasibility study by Bosch

Whether a product has the potential to generate business and profits can be understood by measures like Net Present Value (NPV), cost-benefit analysis, Internal Rate of Return (IRR), or decision analysis.



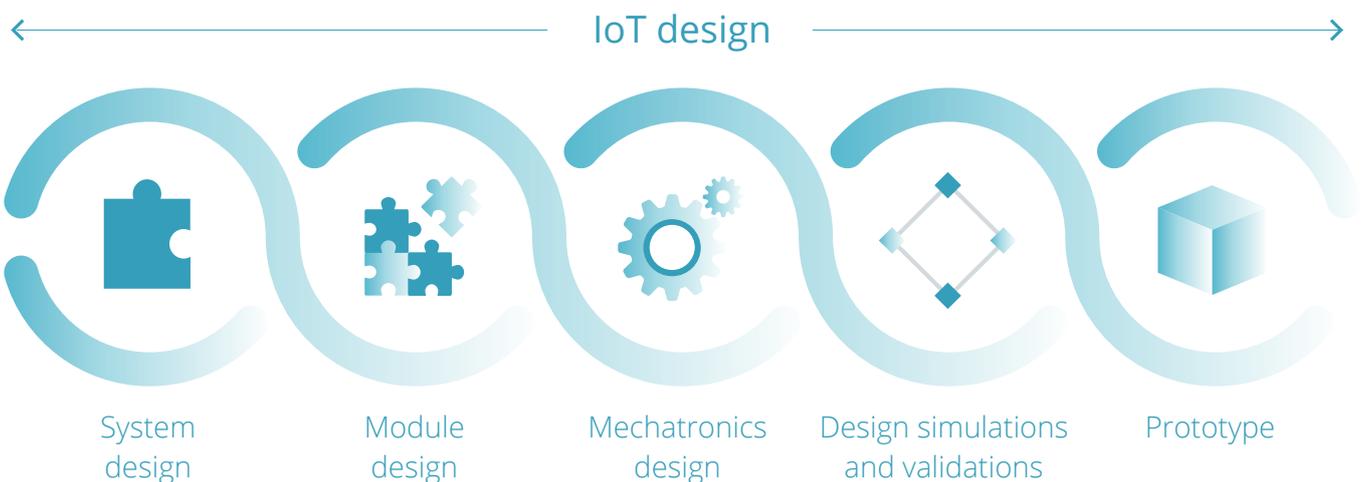
Step 3: Solution design

The challenges identified are taken to the product development team, who, in turn, comes out with a solution architecture or product blueprint.

Engineers are encouraged to think about problems and the approaches to solve these, from a customer point of view.

Design-thinking practices are followed as a part of the design process. Engineers think about the environment in which the product will be used, the types of end-users, and the applications for the product.

Stages involved



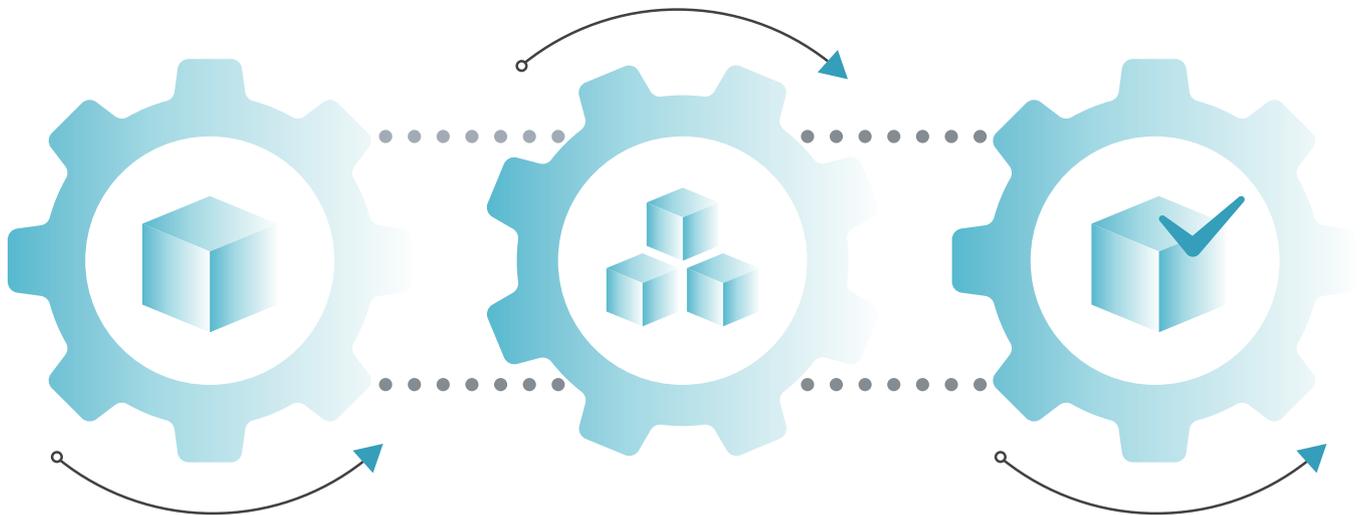
Thermal and EMI simulations
Engineers check how the heat is getting dissipated



Reliability simulations
They check the impact of vibration and shocks on the internal components



Step 4: Engineering



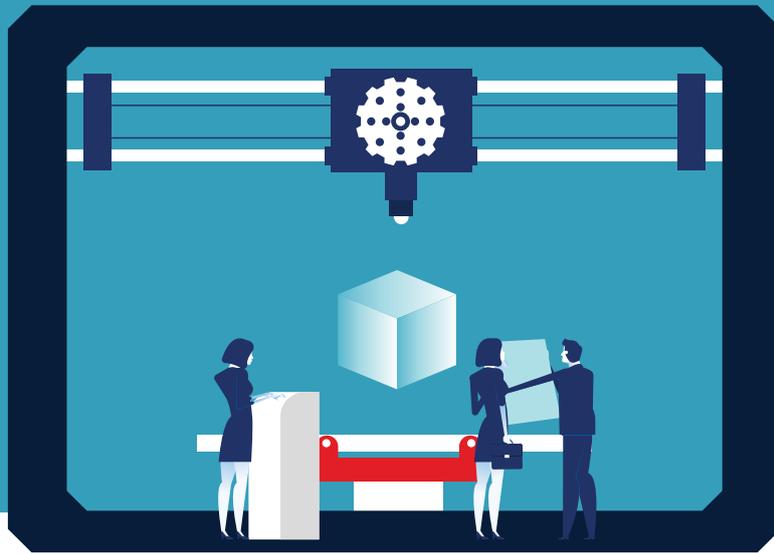
A first version or sample of the product is created. This could be in the form of a plastic or silicon mould. Some manufacturers create styrofoam models to get a 'feel' of the design.

Once sample is approved, a prototype is developed. Many changes are made to these samples, or many versions are created.

A closed group test is conducted to check if the product solves the challenges of the customer, and the product is further improved, based on feedback.

The Bosch Difference

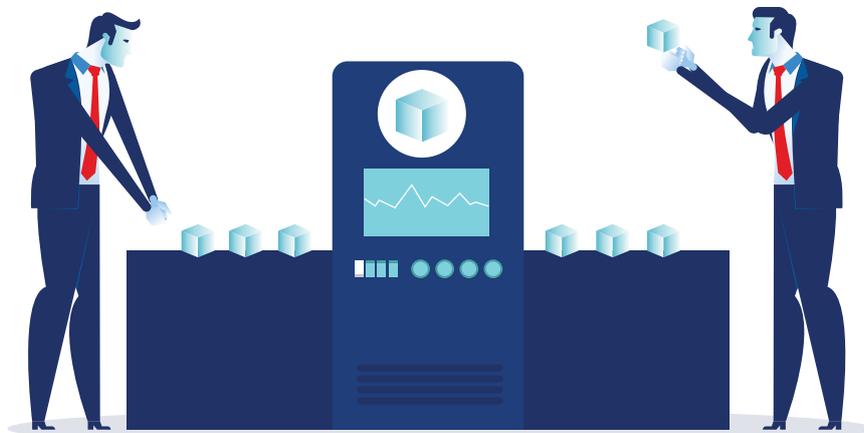
Bosch engineers are always thinking about the environment in which the product will be used, the types of end-users, and the applications for the product. Once a design is approved, the engineering teams create the Product Requirement Document (PRD), which contains elementary information about where the product will be used (environment) and the operating parameters.



Step 5: Industrialization

A few working samples of the product are created for a customer or Original Equipment Manufacturer (OEM).

Once a sample is selected, it undergoes a battery of tests before going into mass manufacturing or production. These rigorous tests check if the sample can withstand pressure, shocks, and extreme temperatures.



Before the product goes into mass manufacturing, the manufacturer must ensure that the product is safe and dependable - and get this endorsed by a certifying agency.

A reliable and safe product

The Bosch team helps you get your product approved by authorities such as ISI (Indian Standards Institute), ANSI (American National Standards Institute), TEC (Testing and Certification of telecom equipment), BIS (Bureau of Indian Standards) etc., and get it certified for environmental safety, electrical safety, health safety, etc.

Development



This step involves mechatronics development, tools development, and development of the cloud platform.

Bosch works in diverse domains ranging from automotive to power tools to thermo techniques. It has people from various engineering backgrounds. So, the product development comes from the core - Bosch engineers.

Pilot Runs and Testing



There are numerous testing processes, such as Noise, Vibration and Harshness (NVH) testing, endurance testing, and standards compliance.

Bosch teams test a product under extreme conditions to ensure that it lasts for the intended duration and that it also complies with the prescribed standards of an industry certifying body such as ISI. It has various competencies and capabilities to ensure this. In the Automotive domain, for instance, it has facilities and capabilities for Automotive Embedded Testing. This is also applicable to other domains.

Process Planning



Bosch has all the capabilities to perform industrialization under one roof. At this stage, Bosch identifies the tasks that need to be performed and the skills required to perform them. Basis this, job descriptions are created and circulated and workable instructions are put together to ensure the job is done right.

Product Launch

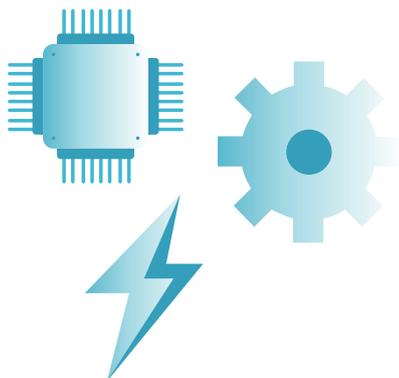


Once a product is ready, marketing plans are rolled out and the new product is coordinated across the supply chain to fix a desired level of production based on the market demand.

What makes
Bosch IoT Solutions
Unique?



At the heart of every connected product is a technology called the Internet of Things or IoT. The unique strengths and capabilities of Bosch lie in this domain.

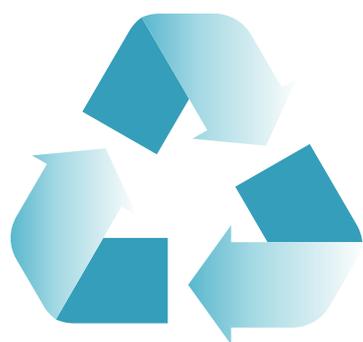
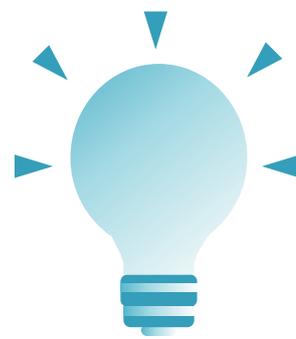


Convergent Ecosystems

Connected products have electronic components, mechatronics, and software within chips (firmware). It requires deep manufacturing and product engineering expertise to ensure that all the components and sub-assemblies work in harmony, within certain environmental conditions. Bosch provides expertise in firmware, mechatronics, and industrialization, with all ecosystems under one roof.

Diversity of Technology

Bosch engineers have a thorough domain understanding across industries. Once they understand the requirement, they get into brainstorming and ideation. With in-depth knowledge and years of experience across domains, Bosch can enable faster time-to-value.



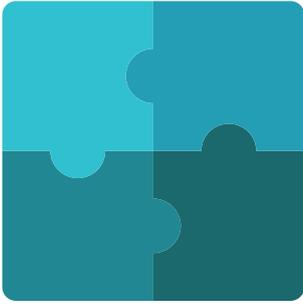
Invented for Life

Building products that last comes with certain responsibilities. There are considerations like reliability to ensure that the product works for the full span of its intended life. Environmental responsibility is a serious consideration too. That means choosing raw materials that are not hazardous to the environment. There are checks for EMI (Electromagnetic Interference) and radiation levels.

Practitioner's Approach

Bosch has developed products across domains. Thus, it can leverage its diverse expertise and rich experience to create innovations.





Single Point of Contact

Bosch can provide solutions from UI/UX to architecture, going all the way to industrialization. Having all its engineering teams under one roof helps create innovative products and bring them to market sooner.

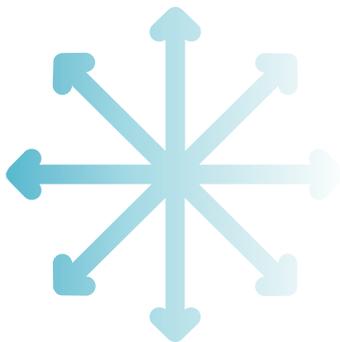
Advanced Infrastructure for Testing and Validation

A manufacturer needs to do pre-compliance checks on a product before sending it to a certification body. Bosch has the required infrastructure and processes in-house to do this. It can do reliability testing as well as testing for emissions (EMI/EMC).



Flexible Business Model

Different customers have different manufacturing requirements. For instance, there's the fixed-price model where a customer gives the product specifications and saves on development costs, which do not increase over time. Another model is the per-piece model. If there is a requirement for 10,000 units of the product, then, based on the production plan, the customer can pay on a per-unit basis. Bosch caters to the unique requirements of different industries by offering flexible business models – from making the prototype to developing the product to taking care of industrialization and mass production.



Cost of development is reduced by **50%** without any compromises on the functionalities of the product.

Your

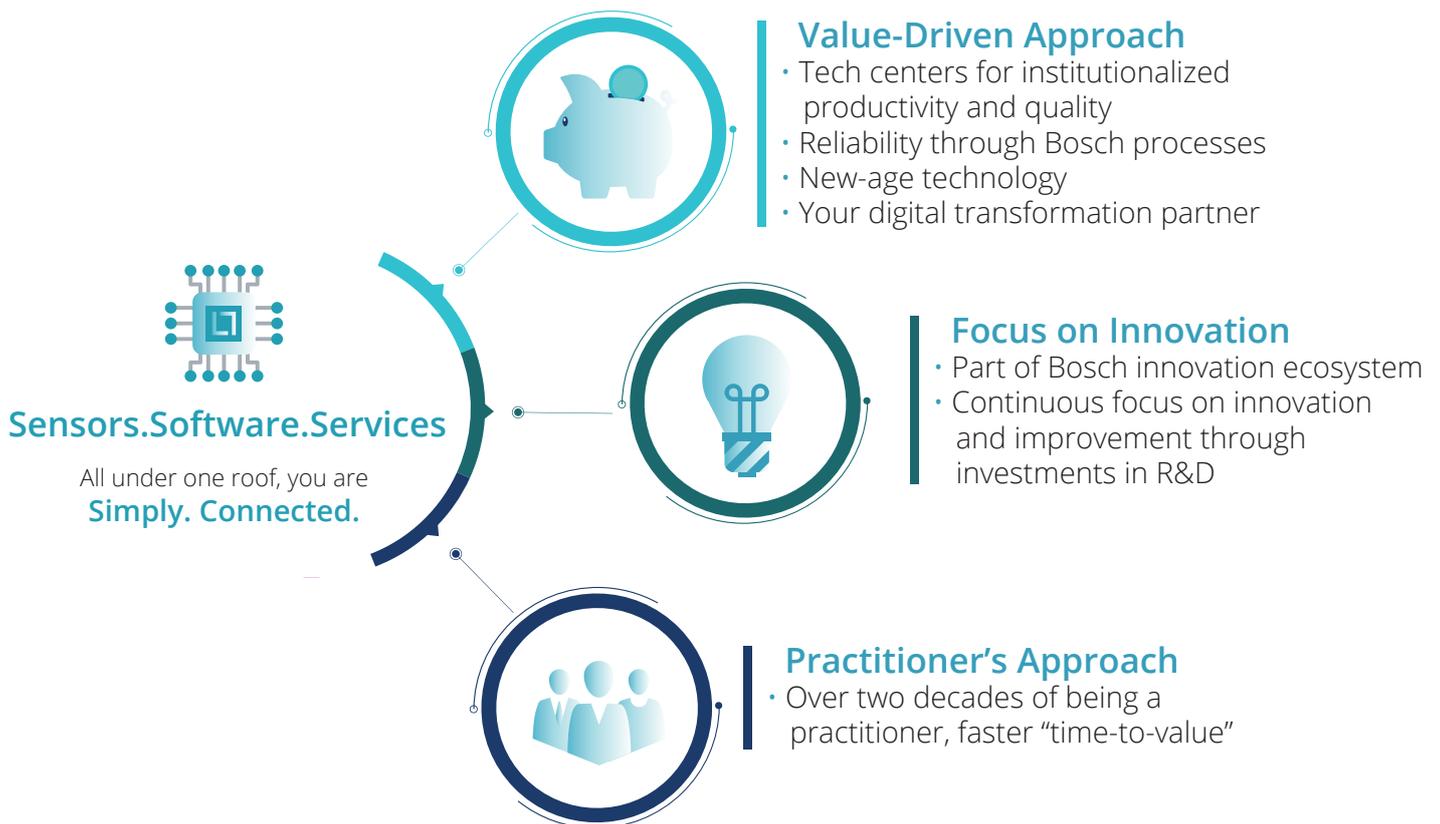
Technology Partner

of Choice



Robert Bosch Engineering and Business Solutions

Your technology partner of choice



Bosch is a global engineering company that has been in existence since 1886. It is regarded as a responsible company that builds reliable, lasting, and sustainable products. For Bosch, sustainability means securing the company's long-term success while protecting the natural resources on which present and future generations depend.

IoT is becoming an integral part of the connected products that are becoming mainstream in our lives.

It takes a company like Bosch, with its robust processes, engineering prowess, extensive domain expertise, and diverse ecosystems, to build connected products that are invented for life.

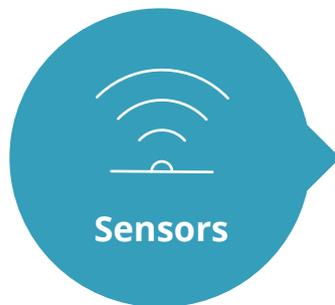
Moreover, companies that want to build innovative, cutting-edge products can depend on Bosch because it takes a Value-Driven approach and a Practitioner's approach for faster time-to-value.

Step into the future with Bosch, your technology partner of your choice.



Product Case Study: Indego – Automatic Lawn Mower

Bosch designed the next-gen cloud-based lawnmower and customized it with sensors and software to allow automatic movement. A simple voice command gets it started, and once it is done, you are instantly notified on your smart gardening mobile app. The lawnmower is also capable of automatic charging, so it is always ready for use. With battery analytics and odometrical sensor data captured by Bosch software, you can enable predictive and preventive maintenance to make your lawnmover last longer.



- Bosch inclinometer, gyroscope, accelerometer, compass wheel encoders
- Wireless loop sensor
- Current sensing (multiple points)



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

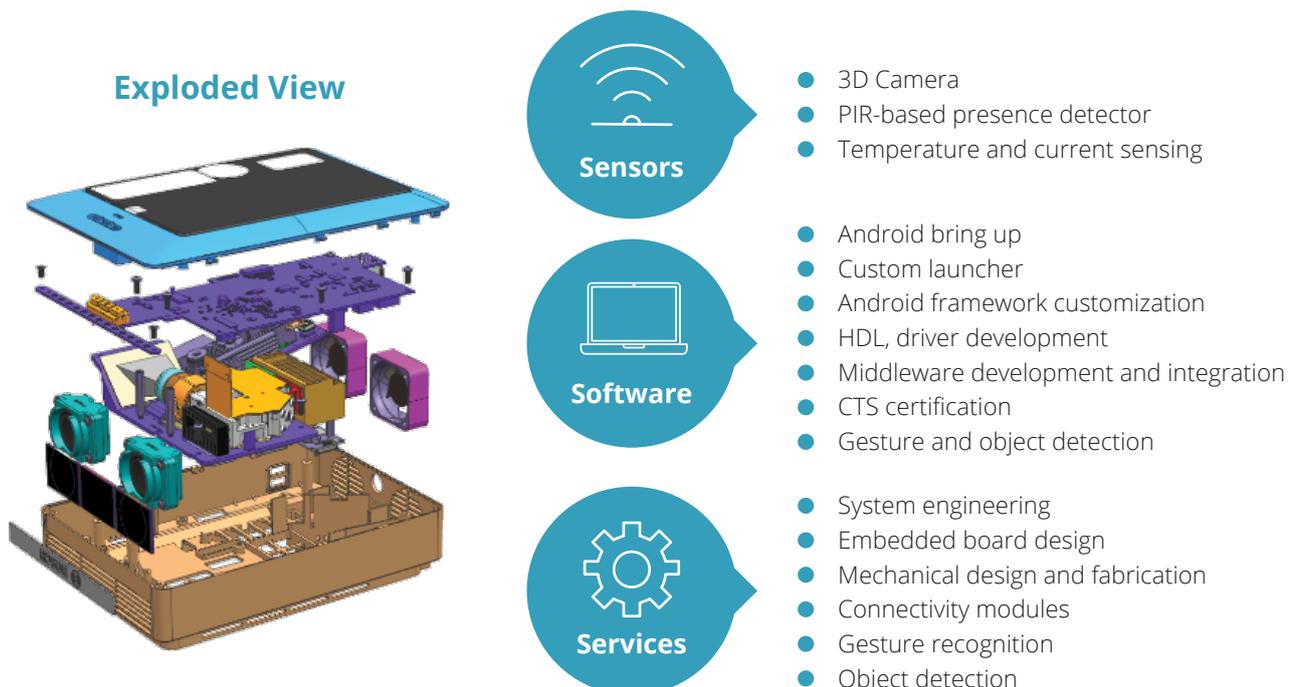
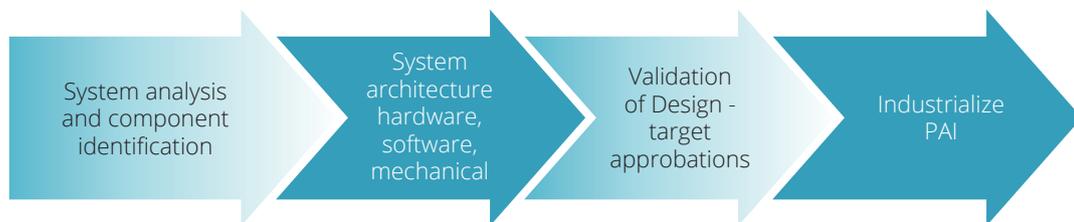


- Cloud connectivity for governance and maintenance
- Inertial navigation System
- Obstruction detection technology designed and deployed
- Mobile app
- Product design and development



Product Case Study: PAI - Projection and Interaction module

Bosch has designed a custom Industrial PAI application based on the analysis of each component of the PAI unit and its architecture. The android framework in the assembly is embedded with speech recognition, which allows a voice interaction between the user and the device. It also connects the android device to a 3D camera through a JNI interface and allows the user to move images through gesture control. All the information retrieved through the interface is made available to the user through the Launcher APK. Bosch can design UI/UX of your application with BSH wire frames, and within 17 months, you will have an industrialized PAI ready.





Product Case Study: Intelligent Data Logger with Edge Analytics

Bosch designed, developed, and industrialized the refrigerator controller, adding sensing capabilities and controls for the compressor. With this controller, you can upload usage and performance data to the cloud and run analytics to get insights. A thermostat function allows the cooler to be operated in normal and energy-saving modes. The edge analytics allows the controller to educate itself by observing the store operations and automatically switch between modes. Bosch offers five variants of the intelligent data logger that supports self-learning for your store operations.



Collecting Data

The Nexo controller collects, holds, and shares data obtained from sensors placed in the beverage cooler



Nexo connects to our cloud database to transfer and analyze data



Sharing Insights

Nexo services delivered to assist owners via the intuitive dashboard on desktop and mobile platforms

Authors

Murali, Deputy General Manager, Product Engineering Services and AR/VR.
Lakshmeesha, Technical Pre Sales, Product Engineering Services



Robert Bosch Engineering and Business Solutions Private Ltd.

123, Industrial layout,
Hosur Road, Koramangala,
Bangalore-560095, INDIA

connect@in.bosch.com

www.bosch-india-software.com

