



*BASELABS GmbH Recognized for*

**2021**

**Enabling Technology Leadership**

Sensor Data Fusion for Autonomous  
Driving Applications Industry

*Excellence in Best Practices*

## Best Practices Criteria for World-Class Performance

Frost & Sullivan applies a rigorous analytical process to evaluate multiple nominees for each award category before determining the final award recipient. The process involves a detailed evaluation of best practices criteria across two dimensions for each nominated company. BASELABS GmbH excels in many of the criteria for sensor data fusion in the autonomous driving applications space.

AWARD CRITERIA	
<i>Technology Leverage</i>	<i>Customer Impact</i>
Commitment to Innovation	Price/Performance Value
Commitment to Creativity	Customer Purchase Experience
Stage Gate Efficiency	Customer Ownership Experience
Commercialization Success	Customer Service Experience
Application Diversity	Brand Equity

### ***Commitment to Innovation***

Sensors are used in almost all applications and devices, including automobiles for braking and traction control and airbags, aerospace to measure environmental conditions, oil and gas, consumer goods in smartphones and wearable devices, and industrial machinery for predictive maintenance and optimal machine utilization. As technology evolves, sensors have undergone several advancements, especially those that deliver accurate data from a number of data points for better decision making to facilitate meaningful actions.

The autonomous vehicle market is one of the key industries impacted by sensors. Until recently, capturing the data required to improve vehicle efficiency was conducted using individual sensors, such

*BASELABS provides sensor fusion as a product, with the key strategy to be independent of sensor providers and manufacturers. Sensor fusion customers, therefore, can be more independent from sensor providers.*

*- Ranjana Lakshmi,  
Senior Research Analyst*

as light detection and ranging (LiDAR), radio detection and ranging (radar), cameras, and magnetic field sensors. Collecting data from multiple sensors, however, has proved to be expensive, time consuming, complicated, and data redundant. In addition, the sensor fusion technology is on the tipping point from being a differentiating technology to being a standardized technology. Under this perspective, a highly efficient development process to slash time to market is of growing importance for the industry.

With data as the key driver for better profit margins, BASELABS GmbH has identified that companies involved in the development of sensors for specific applications cannot use the sensors in other areas because altering the program would be tedious and time consuming. A data fusion platform, therefore, is needed that can adapt to different contexts for extensive opportunities. BASELABS has developed a configurable sensor fusion software that contains relevant building blocks of a data fusion algorithm. The resulting algorithm uses information from multiple sensors for object detection, pedestrian detection, and traffic detection, in addition to obtaining information on the speed of objects around a vehicle. The software is used by BASELABS' customers to develop sensor fusion systems for their production vehicles.

With advancements in the sensor's output interface, unconventional fusion algorithm solutions are required. For instance, conventional cameras installed in automobiles are designed to produce a rectangular image; however, modern cameras are now designed to deliver semantic segmentation for every pixel. The camera provides information on whether the image is a pedestrian, a road, or a car by using different fusion algorithms. Similarly, radar was previously used to detect either the position or velocity of objects around a vehicle. With modern radar technology, however, sensors can show a range of factors, such as displaying the vehicle's contour, size, and orientation in the space using modern fusion technology that incorporates multiple data points from different sources. The evolution of sensors will largely drive advancements in sensor fusion technology.

BASELABS has developed the product "[BASELABS Create Embedded](#)" to correspond with different sensor configurations for varying end applications. The algorithms provided with the product completely support existing automotive sensors, such as LiDAR, radar, and cameras, and offers fusion algorithms that are accurate to hand written codes. Data fusion allows automotive manufacturers to use less time-consuming and easily integral solutions, reducing the cost of purchasing components and installation. In addition, BASELABS offers an innovate platform for varying industrial applications, with easier control over the fusion algorithm for customers that have little or no experience. On the contrary, expert customers achieve faster implementation times and can focus on the performance of the algorithm.

BASELABS's unwavering drive to enhance its products is evident by the services it offers. The company has designed its strategy to solve data processing problems for most market applications by providing a solution that can be easily deployed. BASELABS is focused on the automotive industry. However, in the long term, the firm plans to focus on delivering a scalable, dependable, and easily accessible solution for customers in the manufacturing, railway, and transportation industries.

### ***Commitment to Creativity***

With new projects focused on autonomous driving or machine automation, companies developing sensor fusion algorithms have often had to alter the development setup because of the lack of available standardized sensor interfaces. BASELABS has identified the major challenge in the existing sensor fusion market as the need for a configurable data fusion algorithm that can handle the variety in end applications rapidly and accurately, and at the same time addressing strict safety requirements for production vehicles.

BASELABS develops software for sensor fusion, such as Create Embedded, with a strategy that allows

customers to be more independent of sensor providers and manufacturers. For example, when customers have a sensor or sensor fusion that is not configurable or reusable, they are strongly dependent on sensor providers. If they decide to use a specific sensor, changing/moving to sensors from a new vendor can be difficult. BASELABS's sensor fusion software makes it easier to manipulate the algorithms to suit customers' unique needs, independent of sensor manufacturers.

A strong commitment to provide a configurable sensor data fusion differentiates BASELABS from other market participants. The company's product, which, in essence, is a software library, provides the most commonly used elementary data fusion algorithms that can be easily accessed by customers that have licensed the fusion platform. With BASELABS Create Embedded, customers can configure the algorithm automatically based on existing sensors installed in their end applications. Moreover, the user interface allows end users to define the number of available sensors and configure the data fusion algorithm to function with the system setup and the existing configuration. BASELABS's software can be purchased by licensing the sensor fusion software for use in different projects with less customization, thus saving cost, time, and resources across projects that require fusion technology. The customers get full source code access, so BASELABS actually provides a white-box-approach.

With the sole aim of providing a fully configurable sensor fusion, which is ready to use through a graphical configuration, BASELABS provides a fusion solution that can save significant time in configuring algorithms with the sensor system, thus strongly reducing the need for customers to work on the sensor fusion algorithm.

### ***Commercialization Success***

BASELABS has successfully commercialized its Create Embedded sensor fusion product worldwide, especially among automotive companies. BASELABS actively works with research and academic institutions in Europe to boost adoption and to expand its customer base across other regions. Considering the high rate of activity in industrialization in these regions, the Create Embedded sensor fusion product can benefit other market applications. For instance, many companies, including BMW, Ford Otosan, Mazda Motor Corporation, SAIC Motor Corporation, Scania, Einride, Continental AG, ZF, DENSO, Knorr-Bremse, Huawei, and Siemens, have incorporated BASELABS' fusion technology in several projects.

Commercialization alone, however, is not a key indicator of success for BASELABS. To stimulate the adoption of autonomous vehicles, BASELABS engages in various projects with research labs and academic institutions to promote and create awareness on the benefits of sensor fusion for automotive and other applications using the Create Embedded fusion solution.

The sensor fusion technology can perform a comprehensive range of autonomous driving applications to capture processing and analyze real-time data to generate meaningful results; however, BASELABS is already addressing this trend and is well positioned to expand its product reach.

### ***Application Diversity***

The BASELABS Create Embedded fusion product can be adopted for various aspects of the autonomous driving application. For example, data fusion algorithms can be used for path detection, object

detection, and motion tracking of objects around the vehicle. The main application of the fusion algorithm is Society of Automotive Engineers (SAE) level 1-3 automation, in addition to other major applications, such as automated emergency braking, adaptive cruise control, forward collision warning, and high pilot functionalities.

Furthermore, BASELABS Create Embedded collects quantifiable data of objects around the vehicle, such as position, velocity, and type of object. The rapid data analysis using the fusion algorithm eliminates the false positive assumption from individual sensors, thereby providing the driver and passengers with a safe autonomous feature.

The railway industry is another application opportunity for potential synergies in which BASELABS Create Embedded can be used. Automated train control and an automatic train protection system would be key elements in optimizing railway systems. Create Embedded, along with appropriate sensors, could accurately detect objects on the tracks and around the vehicle, reducing the need to integrate multiple individual sensor systems and instruments and thus decreasing the overall cost of the system. BASELABS has been working with manufacturers of trains and railways, including public transportation and trams, to continue scaling the application of its fusion algorithms.

### ***Customer Service and Purchase Experience***

BASELABS provides customers with a hassle-free experience by removing all the friction involved in integrating the sensor fusion technology in end applications through a platform that is independent of sensor manufacturers. BASELABS assists customers with on-boarding, licensing, and resolving maintenance issues. In addition, the company provides support for installing and operating the sensor fusion for use in automotive applications. The firm has obtained exida ISO 26262:2018, proving the software algorithms are safe for advanced driver assistance systems (ADAS) and automated driving applications.

Frost & Sullivan research indicates that BASELABS' strategy of providing most of the required services and optimizing customers' business practices and functionality appeals to its customers, thus enhancing the company's brand value.

## Conclusion

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Sensor fusion technology is drastically transforming the global automotive industry into a more automated and smart marketplace. BASELABS's industry-leading sensor fusion platform, along with an extensive program library, delivers a high yield in a fraction of the time, compared to functions offered by individual sensors, such as LiDAR, radar, and cameras. BASELABS's system enables industrial participants to analyze data precisely to achieve business success while benefiting from improved performance and safety. As BASELABS continues to introduce cutting-edge technology features into its algorithm, Frost & Sullivan expects this energetic company to continue serving a growing customer base and establish a firm foothold in the market. This long-term strategy is underpinned by the involvement of Vector Informatik as a strategic investor in a stable ownership structure. Vector is a market leader for the Autosar stack and established partner for the global automotive industry for software since more than 30 years.

For its strong overall performance, BASELABS GmbH is recognized with Frost & Sullivan's 2021 Enabling Technology Leadership Award for sensor data fusion in the European autonomous driving applications industry.

## What You Need to Know about the Enabling Technology Leadership Recognition

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Frost & Sullivan's Enabling Technology Leadership Award recognizes the company that applies its technology in new ways to improve existing products and services and elevate the customer experience.

### Best Practices Award Analysis

For the Enabling Technology Leadership Award, Frost & Sullivan analysts independently evaluated the criteria listed below.

#### *Technology Leverage*

**Commitment to Innovation:** Continuous emerging technology adoption and creation enables new product development and enhances product performance

**Commitment to Creativity:** Company leverages technology advancements to push the limits of form and function in the pursuit of white space innovation

**Stage Gate Efficiency:** Technology adoption enhances the stage gate process for launching new products and solutions

**Commercialization Success:** Company displays a proven track record of taking new technologies to market with a high success rate

**Application Diversity:** Company develops and/or integrates technology that serves multiple applications and multiple environments

#### *Customer Impact*

**Price/Performance Value:** Products or services provide the best value for the price compared to similar market offerings

**Customer Purchase Experience:** Quality of the purchase experience assures customers that they are buying the optimal solution for addressing their unique needs and constraints

**Customer Ownership Experience:** Customers proudly own the company's product or service and have a positive experience throughout the life of the product or service

**Customer Service Experience:** Customer service is accessible, fast, stress-free, and high quality

**Brand Equity:** Customers perceive the brand positively and exhibit high brand loyalty

## About Frost & Sullivan

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### Key Impacts:

- **Growth Pipeline:** Continuous flow of Growth opportunities
- **Growth Strategies:** Proven Best Practices
- **Innovation Culture:** Optimized Customer Experience
- **ROI & Margin:** Implementation Excellence
- **Transformational Growth:** Industry Leadership



## The Innovation Generator™

Our six analytical perspectives are crucial in capturing the broadest range of innovative growth opportunities, most of which occur at the points of these perspectives.

### Analytical Perspectives:

- Mega Trend (MT)
- Business Model (BM)
- Technology (TE)
- Industries (IN)
- Customer (CU)
- Geographies (GE)

