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Virtual Sensor - Market Share Analysis, Industry Trends & Statistics, Growth Forecasts (2024 - 2029)

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Abstracts

The Virtual Sensor Market size is estimated at USD 1.04 billion in 2024, and is expected to reach USD 4.09 billion by 2029, growing at a CAGR of 31.38% during the forecast period (2024-2029).

The virtual sensors market has the potential to expand significantly and become a key component in numerous future applications related to physical sensors. The growing adoption of these sensors is primarily driven by the benefits they offer to various industries.

Key Highlights

Virtual sensors, also known as soft sensors, are software-based solutions developed using a mathematical model of multiple output readings from physical sensors. The limitations of physical sensors can be overcome by deploying these virtual sensors. A single virtual sensor can predict various parameters such as speed, temperature, position, and pressure.

As a result, they offer cost benefits and find applications in industries such as IoT, Cloud, security, analytics, process industry, oil & Gas, transportation, automotive, consumer electronics, healthcare, and defense & aerospace. Advancements in the sensor and control industry will drive the growth of the virtual sensor market.

Leading manufacturers are adopting a cloud-based virtual sensing solution as a standard platform. Implementing virtual sensors on a cloud platform offers several benefits, such as enhancing data connectivity between users and the sensor-cloud server.

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Moreover, these solutions facilitate efficient transportation monitoring, accurate weather forecasting, improved military activities, and enhanced healthcare services. The cloud platform also enables end-users to reduce overall ownership costs and expand data storage capabilities, consequently contributing to the growth of the virtual sensor market.

The increasing demand for cost-efficient solutions and improved operational efficiency in the manufacturing sector fuels the adoption of cutting-edge technologies in the industry. To keep their competitive edge and reduce production costs, manufacturing companies of all sizes constantly focus on discovering and applying new tactics. If they optimize their cost structures, they can avoid losing a sizable portion of the market to competitors who can operate more profitably or, worse still, become obsolete. Businesses constantly seek creative ways to cut expenses without sacrificing productivity or efficiency.

Furthermore, due to increased digital transformation, cloud computing demand has skyrocketed across organizations. The cloud offers extensive benefits over the on-premise deployment, which fuels the adoption of cloud services. The prevalence of new small-scale companies and startups based on the cloud from their inception influences the demand for cloud computing skills.

Virtual Sensors Market Trends

Transportation and Automotive Industry to be the Fastest Growing End User

The increasing usage of digital twin technology in the transportation industry is expected to drive the demand for virtual sensors. Digital twins have emerged as the most recent technological phenomenon in the transportation sector. The implementation of digital twins in supply chains is enhancing the efficiency of supply chain networks on both local and global scales. By utilizing the data, transportation companies can accurately predict their operations. Significantly, this innovative technology also generates valuable insights to enhance corporate strategies.

Virtual sensors are increasingly becoming crucial for the automotive industry due to their wide variety of applications. The growing adoption of virtual sensors in the industry will enable the market to gain traction over the forecast period. Amidst this costly sensory inflation, adopting virtual sensors has become prevalent.

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Virtual sensors entail replacing a physical sensor with software embedded in the vehicle's electronic control unit. The objective is to acquire essential information without needing a physical component. Numerous vehicle parts, including tires, engines, and cabins, are embedded with these virtual sensors. Virtual sensing is widely employed in automotive applications, such as passenger thermal comfort, tire pressure monitoring systems, powertrain applications, estimation of sprung mass state, and others.

The automotive sector depends significantly on sensing technology for various functions such as safety, entertainment, traffic management, navigation, and guidance. With the advancement towards autonomous vehicles, sensing device usage is expected to grow. Despite the high cost and occasional unreliability of physical sensors in vehicles, virtual sensors are emerging as a cost-effective solution for car makers. These virtual sensors serve as a secondary safety measure to physical sensors and play a crucial role in enhancing driver assistance systems (ADAS) and ultimately achieving autonomous driving capabilities.

The growing demand for ADAS features in the automotive industry is expected to drive the segment's growth. Several governments worldwide are implementing various measures to boost the adoption of ADAS technology to ensure vehicle safety. Furthermore, the increasing trend of autonomous or self-driving vehicles also plays a role in expanding the market. As an illustration, Intel predicts worldwide car sales will exceed 101.4 million units by 2030, with autonomous vehicles projected to make up approximately 12% of car registrations by the same year.

Furthermore, Artificial Intelligence (AI) has become vital in various industries, including the automotive sector. A significant innovation in this field is the creation of advanced driver assistance systems (ADAS), which are designed to enhance vehicle safety and assist drivers in different driving situations. The adoption of ADAS technology is increasing in countries such as Germany, China, and India, as it has the potential to reduce accidents and promote road safety. Such factors in boosting ASAD technology may present significant opportunities for the market.

Asia Pacific Expected to Witness Significant Growth

Virtual sensors are significant in facilitating the operation of smart devices and automation. Virtual sensors are crucial in driving demand for IoT (Internet of Things) by enhancing the capabilities and functionalities of connected devices and IoT systems.

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China’s continuous technological progress and investments in Artificial Intelligence (AI) and IoT (Internet of Things) fuel the demand for the market studied. Government Initiatives like the “Made in China 2025” plan have placed a strong emphasis on advancing high-tech industries, such as IoT ((Internet of Things). This support from the government has accelerated the research and innovation in IoT, leading to its adoption in multiple sectors of the economy.

Organizations can deploy virtual sensors on cloud infrastructure without needing dedicated hardware or physical installations, reducing the deployment time and operational costs. Cloud adoption in Japan is experiencing significant growth due to the continuous transition from on-premise to cloud-based systems and increasing demand for cloud-focused systems. For instance, in January 2024, Amazon Web Services announced its plans to invest JPY 2.26 trillion (USD 15.24 Billion) into its current cloud infrastructure in Tokyo and Osaka by 2027 to address the increasing customer demand for cloud services in Japan. According to the AWS Economic Impact Study (EIS) for Japan, this investment is projected to add JPY 5.57 trillion (USD 37.6 Billion) to Japan’s GDP.

The automotive sector depends hugely on sensing technology for various safety-related tasks, traffic management, navigation, and guidance. Virtual sensors offer an additional layer of protection to physical sensors and play a crucial role in advancing ADAS (Advanced driver assistance systems) and, ultimately, in creating autonomous vehicles.

The automotive sector of India has always been a reliable gauge of economic performance, as it is a crucial player in both economic growth and technological progress. ADAS (Advanced driver assistance systems) enhances vehicle safety by preventing or minimizing the impact of potential accidents and is gaining importance in the Indian automotive market. The demand for advanced safety features like ADAS is vital in the current market. For instance, in January 2024, Mobileye Global Inc. plans to provide advanced driver assistance technology for upcoming Mahindra & Mahindra Ltd vehicles to expand its presence in India’s automotive industry.

Virtual sensors fuel demand in the aerospace and defense sector by enhancing navigation capabilities, aircraft health monitoring, and autonomous systems. Additionally, the investments in aerospace and defense smart factories drive demand for virtual sensors by enabling quality control, predictive maintenance, and supply chain integration. For instance, In February 2024, GE Aerospace declared that it would be investing SGD 15 million (USD 11 Million) to upgrade the aircraft engine repair facility in

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Singapore into an innovative Smart Factory aimed at modernizing engine repair practices and enhancing the advancements in technology.

Virtual Sensors Industry Overview

The virtual sensors industry is marked by a diverse mix of large international firms and smaller, medium-sized businesses, resulting in a highly fragmented market. Leading companies in this sector include Schneider Electric SE, Elliptic Labs ASA, Modelway SRL, Cisco Systems Inc., and General Electric Company. These companies are engaging in strategies like forming partnerships and pursuing acquisitions to expand their product ranges and secure a competitive edge in the market.

March 2024 - Elliptic Labs announced that it is currently deployed in over 500 million devices and is shipping the AIAVirtual Proximity Sensor INNER BEAUTYon Vivo’s V30 smartphone.

January 2024 - IntelliDynamics announced that a gas producer in Eastern Europe has renewed its support and maintenance for its Intellect systems. IntelliDynamics will Provide virtual metering and hydrate inhibitor estimation. The system tells them in real-time how much gas, condensate, and water they are producing and calculates the amount of methanol/ethanol hydrate inhibitor to inject in multiple points in their production train and central processing to prevent their system from icing up.

Additional Benefits:

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