# IOB
# ENHANCING IOT WITH BEHAVIOURAL ANALYTICS

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DELL Technologies
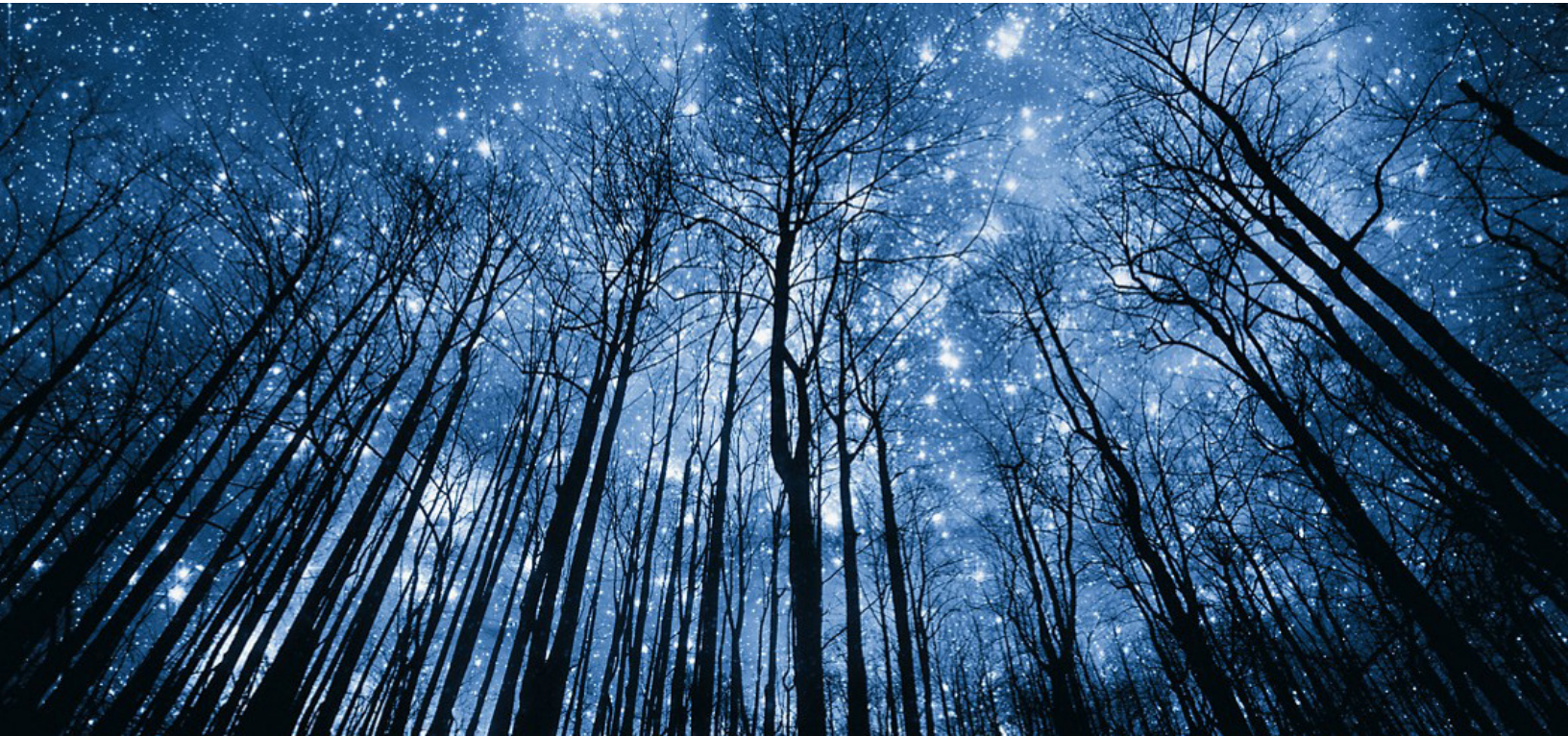
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# INTRODUCTION

One of the major growth drivers for businesses is the ability to provide personalized customer service. IoT technology has been instrumental in collecting and handling customer data. The quantity of connected IoT devices reached 12.2 billion in 2021, and by 2025, it is expected that there would be 27 billion active endpoints worldwide. The information gathered by IoT devices on user behavior, interests, and preferences is indeed the base. An attempt to enhance and analyze this has opened door to a new world the IoB, Internet of Behavior. Gartner predicts that the behavior/activities of 40% of the population would be digitally tracked by 2023 and a significant part of the world will become a part of at least one IoB program soon.

The gathering and application of data to influence behavior is known as the "Internet of Behavior." This information is gathered by domestic electrical appliances, personal internet activities, and wearable technology, and they can provide important details about user behavior and preferences. Activities such as making purchases or adhering to a particular online brand are tracked and analyzed using advanced technology like machine learning. IoB can be thought of as an intersection of the fields: Technology, Data Analytics and Behavior Science.

This new technology is proactive as well as descriptive, aiding in the analysis of user behavior and identifying which psychological elements to affect in order to produce a particular result. It affects consumer decision-making and gives businesses the opportunity to enhance the customer experience with the products and services they provide. Considering Uber's IoT application as an illustration, it is employed to monitor both drivers and passengers. At the conclusion of each trip, a survey is taken to understand the passengers' overall satisfaction. They can employ IoB instead of IoT and avoid the need to conduct a survey to understand the passenger experience. It is feasible to track the driver's conduct and then analyze the passenger experience to automatically act on feedback.

The impacts of IoB within a business and across different verticals are several. Some of them are covered below-

- Improvement in Sales: By understanding customer behavior, the user experience can be improved in terms of providing them with the services they need. Sales touch points can be improved along the customer journey.
- Betterment in Marketing: Aligning marketing campaigns with expectations of customer by pulling data regarding preferences in product, shopping locations and time and evaluation of the effectiveness of the campaign by analyzing the customer behavior.
- Enhancement in Customer Experience: Improving Customer experience throughout the journey from helping with precise recommendations to tracking and keeping a check on post purchase behavior.
- Overall improvement in Products and Services: Assess the success of the product and service based on consumer demand and how well it satisfies their needs.

The Internet of Things is already used by many businesses, and the Internet of Behavior is expanding. IoB is a brand-new field of study that has a lot of potential to advance Web 3.0 and Industry 4.0.

Impact across different Verticals:

- Insurance: The Internet of Things (IoT) gadgets that are mostly utilized in the auto industry for vehicle monitoring can also be used to learn more about a driver's health and driving habits. The businesses monitor how drivers behave on the road and work

with the IoB to make individual decisions in each case. By utilizing IoB in the insurance sector, firms will be able to reduce the amount of car accidents and promote safer driving practices.
- Healthcare: A highly effective relationship of healthcare and technological advancements like the IoB results in several advantages for public healthcare, including improved chronic disease tracking, early disease prevention, advancement of a more rational approach to well-being, smoother access to health care via telemedicine, and more.
- Retail: A lot of retail companies, like Walmart, Amazon, and more, already use parts of IoB in their operations. The data collected from devices and user profiles is used by numerous online services, like Netflix, Amazon, Google, and a plethora of others, to enhance product suggestions and customize advertisements based on user preferences.

One of the most important technological advancements for organizational effectiveness is the Internet of Behavior. That is because it enables businesses to fully comprehend and cater to the demands of their customers. IoB, however, can be used effectively for much more than marketing; it can also be used to monitor public health, provide insurance, and more. Although the IoB offers both benefits and drawbacks, like any technology, it has the ability to make life easier for consumers, boost commerce, and help governments deliver better services to their inhabitants. It will be crucial to create a balance between tailored offerings and intrusion in order to prevent negative consumer reactions. Any business that adopts an IoB strategy needs to have robust cybersecurity to safeguard all of that private information.

This article dives deep into the following subtopics:

- Detailed overview of IoB
- Impact of IoB in different domains
- Benefits and Pitfalls of IoB
- Applications of IoB in different industries
- Future of IoB


# DETAILED OVERVIEW OF IoB


## IoT Recap

One must first understand IoT before delving into the specifics of the IoB. In a nutshell, the Internet of Things (IoT) is a network of connected and interconnected objects. Most of the smart devices we use are a part of it. The following are a few instances of tools used in the IoT:

- Wearable Tech
- Autonomous Automobiles
- Home appliances
- Technologies and tools used in smart cities
- Security systems

IoT systems collect data about the behaviors and actions of their users' using sensors and devices. They then transmit this information without human intervention to other networked

devices. IoT is essential in a variety of businesses, including Healthcare, Government, Retail, Transportation, Utilities, Fitness, Finance, Agriculture and many more.

## The relation between IoT and IoB

IoB data analysis can be linked with CRM (Customer Relationship Management), ERP (Enterprise Resource Planning), SCM (Supply Chain Management), business intelligence, and other forms of enterprise software, much to how an IoT device broadcasts data to a central database for enterprise resource planning (ERP) or supply chain management (SCM). The IoB can be integrated into essential business operations for various types of firms, thanks to this method of analyzing and comprehending human behavior.

The volume of data created by IoT increases along with the number of users and devices connected to the network. IoB steps in at this point. The information about consumers and their actions that is gathered by IoT tools and devices is essentially what is the base for IoB. Their interests, choices, actions, emotions, and other usage-related notions are explained by IoB in relation to this data. In other words, the IoB takes the knowledge and insights generated by the IoT and turns them into information that can be used by the user, the business, or both.

If you own a fitness tracker, for instance, you will also utilize the corresponding mobile app. Thanks to the Internet of Things, this software tracks activity, sleep, and more. However, IoB uses the information gathered to generate recommendations, such as how to enhance sleep hygiene.
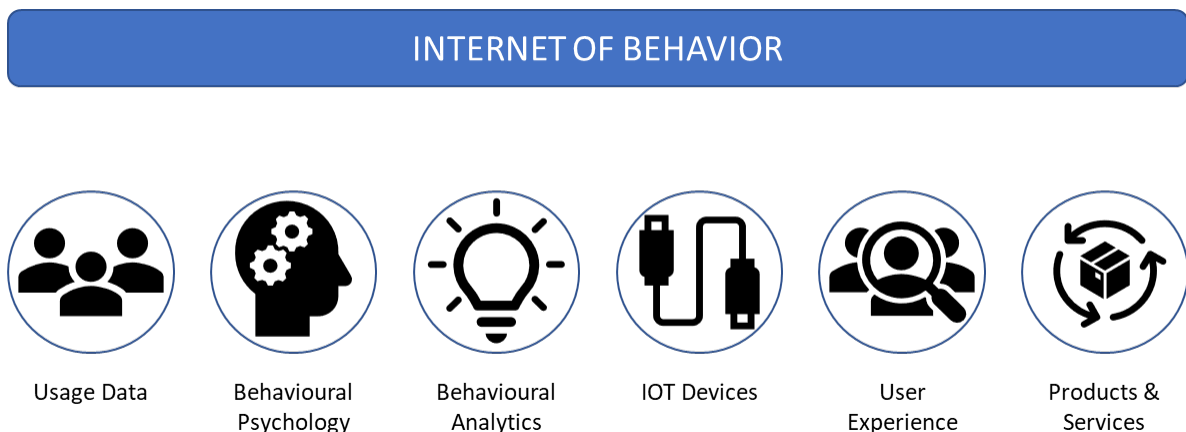


Fig 1. Internet Of Behavior

The Internet of Things (IoT) is necessary for IoB to exist; nevertheless, the IoB is equally essential to the IoT's productivity. At the end of the day, it expands IoT's capabilities to comprehend human behavior and how it influences the same. A variety of contexts, including buying, selling, interacting, tracking, and many others, involves behavior and decision-making.

## IoB: What and Why?

The IoB goes beyond conventional analytics. Using feedback loops, IoB data and technology may be leveraged to impact behavior.

Driving too quickly? To provide a warning for the driver to slow down, an IoB device can broadcast data to a central system or process the data using edge computing. Importantly,

this warning can be produced in real time using 5G and other networking technology, allowing the driver to rapidly adjust their conduct.

Consumer behavior can be affected by IoB systems that affect employee behavior. Government groups can also use IoB to affect their constituents. Given the fact that human behavior is a key component of almost everything people do, the Internet of Behavior has significance that transcends the traditional borders of business and government.
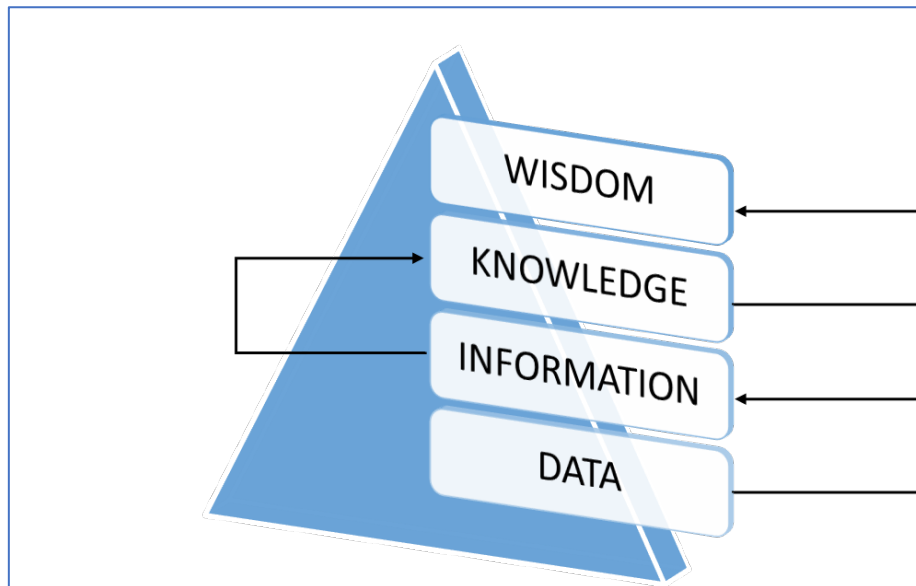


Fig 2. Understanding IoB

IoB can be conceptualized in two high-level stages:

1. Measuring: Gathering and Recognizing

The ongoing use of big data from numerous sources (including, but not limited to, IoT) to gauge and comprehend people's behavior in specific circumstances.

2. Persuading: Motivating Action

The information gathered can be expanded upon and honed to guide our behavior in particular circumstances. The most frequent usage of this will be in a commercial setting, possibly most frequently in retail, but there are other examples where governments use this kind of hyperconnectivity across numerous data points.

A tremendous amount of unique data is provided by every gadget synchronized or linked to the internet. Social media platforms receive data about our online activities each time we access them. IoB concentrates on certain data. For instance, it examines the page you launched first, how long you scrolled it for, the page you launched next, and the number of times you repeated the same set of actions. For instance, you may know that you will be taking a trip at the start of January but are not sure whether to go to Miami or Los Angeles. The IoB will utilize this information to give you the most precise advertising on those locations on certain days. So how exactly can businesses use the IoB, and what are the advantages for users? There are many different approaches. Improving the product's user experience (UX) is one of the key goals of getting insights from the IoB. UX designers and developers may maximize features that appeal to users the most by paying attention to how consumers use their devices, particularly their usage habits. Using this information also

enables businesses to tailor their offerings based on customer needs and preferences, promoting continued reliance on the good and the company.

This is beneficial for more reasons than just enhancing a good or service. Companies can use IoB data for market research to evaluate the effectiveness of marketing efforts and improve them going forward, as well as to get feedback from product testers and fine-tune products before release.

In addition to serving businesses, the IoB also benefits users. Examples include how patient status can be observed by healthcare-related applications and deciding if a patient needs medicine refills or how active they are in order to adjust or recommendations.

Gartner claims that the COVID-19 protocols have even been enforced via the IoB. For instance, sensors or RFID tags at an industrial site could detect whether workers were washing their hands, while computer vision could identify whether they were wearing masks.

In the end, the IoB is useful both as a platform for evaluating people's psychology and actions and as a marketing tool. In order to help businesses and organizations improve their ability to produce better products and enhance the experiences of consumers, this crucial concept goes beyond what can be accomplished with conventional marketing techniques.

## IMPACT OF IoB IN DIFFERENT DOMAINS

Impact of Internet of Behavior will rely on the company or organization using the IoB system, just like the influence of other types of technology. Since human behavior encompasses a vast and diverse range of attitudes and activities, the discussion will emphasize on common commercial benefits for sales, marketing, production and services, and customer experience.

### Sales
The IoB can be applied to sales to personalize the customer experience, better target marketing initiatives, and increase the overall effectiveness of the sales process. For instance, a salesperson can give more individualized discounts or promotions and make more informed recommendations based on information about a customer's browsing and purchasing history. Additionally, the utilization of behavioral data by sales teams can enhance the success of their outreach efforts by assisting them in locating and focusing on high-value prospects. The IoB has the ability to greatly enhance sales teams' effectiveness and boost firms' income.

### Marketing
The Internet of Behavior (IoB), which offers businesses a wealth of information and insights about the preferences and actions of their customers, can have a big impact on marketing. This data can be utilised to target and segment marketing campaigns more effectively, personalize the consumer experience, and maximize the overall efficiency of marketing initiatives.

The following are some instances of how the IoB can be applied to marketing:

- Delivering personalized product recommendations, content, and offers based on a customer's browsing and purchasing history

- Examining social media engagement and activity to spot important influencers and concentrate marketing efforts on a select group of people
- Providing location-based or context-aware marketing messages by using information about client location, search history, and other aspects

Additionally, by offering insights into the customer experience and using that knowledge to optimize the conversion funnel, the IoB can enable more precise and effective marketing efforts. Overall, the IoB has the potential to greatly enhance the effectiveness of marketing initiatives and increase revenue for businesses.

## Production and services

There are various ways to view how Internet of Behavior (IoB) affects products and services. Utilizing behavioral data can assist organizations in multiple ways:

- Enhance client satisfaction by customizing product recommendations, deals, and promotions.
- By obtaining information on how things are being used and identifying opportunities for development, designs and functions of items can be improved.
- By giving customer service employees knowledge of how customers are interacting with products and spotting possible problems, you can improve customer assistance.
- By offering dynamic and individualized experiences through connected products and services, you can increase client engagement.
- IoB can also be used to collect consumer input, which can be utilized to comprehend consumer wants and preferences and guide product development and design.

In general, the utilization of behavioral data can assist firms in better understanding their clientele and meeting their demands with more efficient goods and services. Increased client satisfaction, loyalty, and earnings may result from this.

## Customer Experience

By giving businesses access to a plethora of information and insights about the habits and preferences of their consumers, the Internet of Behavior (IoB) can have a substantial impact on the customer experience. Utilizing this data helps tailor the customer experience, foster more fulfilling relationships, and increase customer loyalty and retention.

The following are some instances of how the IoB can be utilized to enhance the client experience:

- Offering advice, content, and offers that are specifically customized to the needs and tastes of the customer.
- Providing a seamless and consistent experience by examining consumer interactions across several channels, including in-store, internet, and mobile.
- Identifying client needs and pain spots using behavioral data, then proactively addressing them with customized offers or solutions.
- Putting real-time analytics and monitoring into practice to monitor customer interaction, sentiment, and feedback and use that data to enhance customer care and support
- Establishing customized rewards and loyalty programs for each consumer based on their interests and behavior.

IoB can assist organizations in better understanding their clients, predicting their needs, and customizing their interactions. Increased customer happiness, loyalty, and retention can result from this, which will ultimately enhance sales.

## BENEFITS AND PITFALLS OF INTERNET OF IoB:

### Benefits of IoB

Businesses are always vying with one another for the trust of their customers. Companies using IoB will use such data, information, and behavior patterns to meet the demands of their customers.

For instance, Netflix makes predictions about what users will like or dislike using consumer insights. They add recommendations based on their preferences and evaluations of a certain film or television show. Imagine if they could just use your behavior and infer your interests without needing any of your historical viewing information to suggest what to watch next.

Your user experience will be improved, and things will advance. Similar to how different companies may analyze your real-time data to reveal and anticipate what you might need next without you having to do manual web searches.

Stephen Wolfram's computational knowledge engine, Wolfram Alpha, can quickly produce information from a person's Facebook activity. For the past ten years, the British scientist has tracked his own data to better understand how it has affected his behavioral patterns. He claims that data collection through personal analytics improves relationships between customers and businesses.

With the consent of the people whose data is used, IoB can open up greater opportunities for businesses to gather and process data. Companies hope to track employee behavior with the help of IoB in order to improve the employer-employee relationship.

All of this enables businesses to better customize their goods and services to the needs of the customer, but the information additionally gathered can be used to:

- Close deals and keep consumers happy, find solutions to issues.
- Substitute a few consumer surveys.
- Analyze the purchasing patterns of customers across various channels
- Analyze elusive information about how users and customers engage with services, goods, and gadgets.
- Real-time alerts and direction can be provided.
- Analyze the success of commercial and nonprofit campaigns.
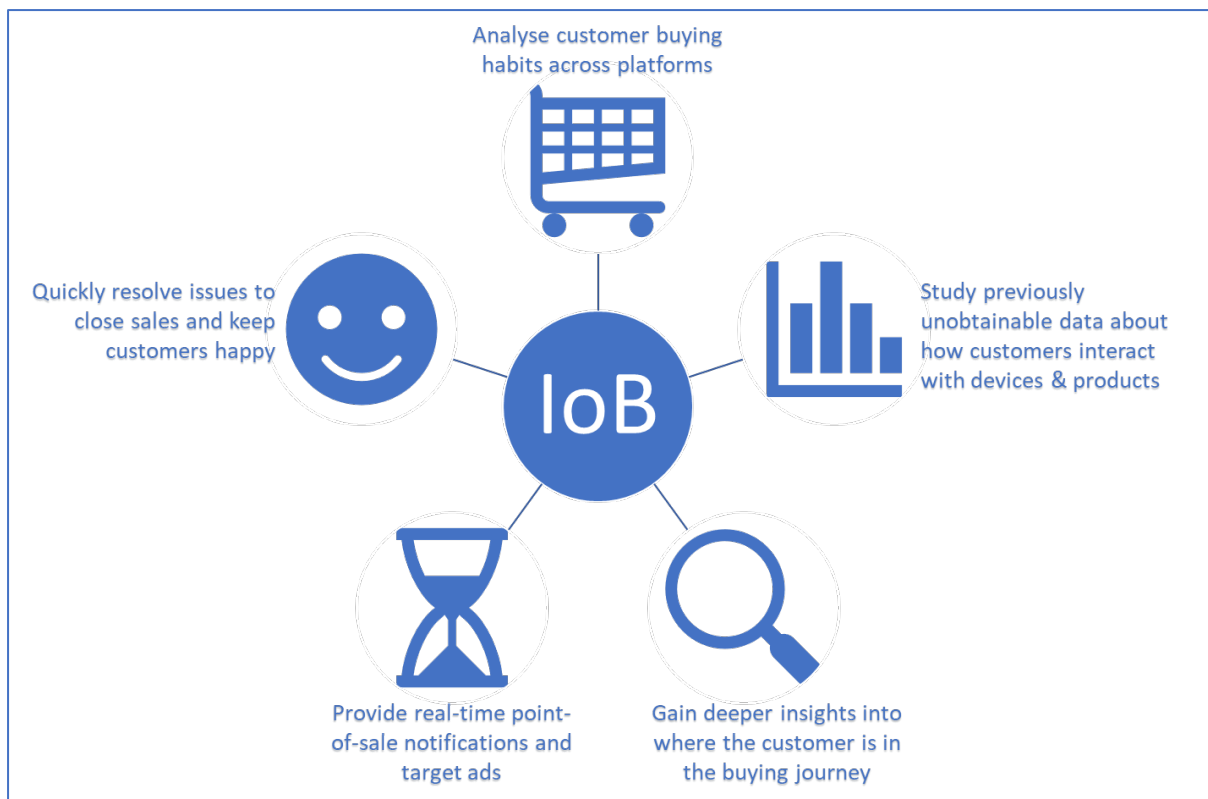- Governments can alter the information in support programs and materials for new laws

Fig 3. Advantages of IoB

## Pitfalls of IoB

Some potential drawbacks of the Internet of Behavior (IoB) include:

- Privacy reasons: Issues concerning privacy and data security might arise from the gathering and use of behavioral data. Customers could be worried about how their information is gathered, used, and whether it is disclosed to outside parties.
- Ethical issues: Using behavioral data to sway and manipulate consumer behavior can be questionable. Businesses must be open about how they use behavioral data and make sure they are not straying from acceptable ethical standards.
- Technology dependence: The IoB depends significantly on technology, thus any problems or malfunctions could interrupt client experiences and have a negative effect on the firm.
- Cost: Businesses may incur expenses in implementing and maintaining the infrastructure and technology needed for the IoB.
- Bias: Data bias can result in decisions being made unfairly and incorrectly. This can be because of the sample, the way the data was gathered, or the method applied.
- Data overload: It might be challenging to comprehend and make sense of the enormous amount of data that is generated.
- Misinterpretation: It is possible to interpret behavioral data incorrectly, which can result in incorrect inferences and subpar decision-making.

These possible drawbacks should be carefully considered by businesses, and steps should be taken to reduce them, such as enforcing tight data privacy policies, being open and honest about data usage, and making sure that any data-driven decisions are done in an ethical and just manner.

# APPLICATIONS OF IoB IN DIFFERENT VERTICALS

## Healthcare Industry

The Internet of Behavior (IoB), which gives healthcare practitioners access to a variety of information and insights about patients' preferences and habits, has the potential to have a substantial impact on the healthcare sector. This data can be utilized to target and segment health campaigns more effectively, customize patient care, and increase the overall efficacy of health activities.

The following are some instances of how the IoB can be applied in healthcare:

- Personal treatment plans are made using information on medical history, lifestyle, and behavior of patients.
- Analyzing patient participation and adherence to treatment regimens in order to spot possible problems and give specific support
- Using patient location and demographic information to give context- or location-aware health messages
- Utilizing linked devices, such as wearables, to collect information on patients' vital signs and activity levels in order to track their health and spot any early warning indications
- Offering tailored therapies to individuals who are at high risk of developing chronic diseases

By offering insights into the patient's journey and using that knowledge to optimize the treatment plan, the IoB can also enable more accurate and effective health interventions. The IoB has the potential to considerably raise outcomes for patients in terms of overall health and healthcare professional performance.

## Manufacturing Industry

The Internet of Behavior (IoB), which gives manufacturers access to a wealth of information and insights on the behavior of their products, machinery, and workers, has the potential to have a big impact on the manufacturing sector. The effectiveness, efficiency, and productivity of manufacturing activities can be increased using this information.

The following are some instances of how the IoB can be applied in manufacturing:

- Utilizing sensors to collect information about how machinery and equipment is used and performing in order to forecast when maintenance or repairs will be required and to plan for those needs
- Monitoring and analyzing workflow and attendance data to spot and resolve any issues that might be affecting employee productivity
- Using supply chain and logistics data to improve the flow of supplies and goods, cut waste, and boost efficiency
- Identifying patterns in production data, such as defects or delays to enhance the quality and efficiency of manufacturing
- Observing how the product behaves in usage enables the producer to enhance product design, deliver more efficient customer service, and anticipate when replacement components may be required.

IoB can help manufacturers learn more about how their staff, equipment, and products behave, which can help them increase the effectiveness, efficiency, and productivity of their business. This may result in more earnings and a stronger competitive position in the market.

## Travel & Tourism Industry

The IoB can be applied in the travel and tourist industry, in the following ways:

- Travel recommendations, offers, and discounts are tailored based on consumer browsing and purchasing history.
- Providing a seamless and consistent experience by examining client interactions across several platforms, including online, mobile, and in-person.
- Delivering location-based or context-aware marketing messages by using information on client location and search queries
- Spotting customer behavior trends to improve pricing and inventory control
- Utilize data to comprehend consumer demands and tastes and to guide product development and design.

## Finance Industry

The following are some instances of how the IoB can be applied in the financial sector:

- Delivering specialized financial suggestions, offers, and discounts based on consumer behavior and preferences to enhance the customer experience.
- Providing a seamless and consistent experience by examining client interactions across several platforms, including online, mobile, and in-person.
- Delivering location-based or context-aware marketing messages by using information on client location and search queries
- Spotting customer behavior trends to improve pricing and inventory control
- Utilize data to comprehend consumer demands and tastes and to guide product development and design.
- Keep an eye on client opinions and feedback to enhance the shopping experience and boost customer happiness.
- Utilizing behavioral data to forecast future consumer behavior, including credit risk and fraud, predictive analytics enables financial institutions to take preventative action

IoB can assist financial institutions in better understanding their clients' needs and meeting those needs through more effective service delivery. Improved risk management capabilities as well as higher levels of client happiness, loyalty, and revenue may result from this.

## CONCLUSION: FUTURE OF IoB

The IoB's applications include those in the fields of healthcare, marketing, and public policy, with the overall objective being to develop a more effective and efficient means of understanding and influencing human behavior.

The amount of data being gathered and analyzed is projected to increase more in the future of the Internet of Behavior, along with the creation of more advanced algorithms and techniques for doing so. Artificial intelligence and machine learning are also anticipated to be used more frequently in order to better understand the vast amounts of data being gathered and forecast human behavior.

One of the specific benefits of the IoB is that by giving corporations and governments a better understanding of human behavior, it may enable them to make more informed decisions. For instance, this could be applied to make public policy more effective or to support businesses in developing more specialized and successful marketing efforts.

However, there are also questions about how the IoB would affect privacy and security, as well as the possibility that the information gathered will be misused. As a result, it is crucial that businesses and governments take action to guarantee that data is gathered and used in an ethical and responsible manner.

In essence, the Internet of Behavior has immense potential to advance numerous industries in future, but at the time it is also necessary to consider the technology's ethical and privacy consequences.

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