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A STUDY ON INTERNET OF BEHAVIORS (IoB)

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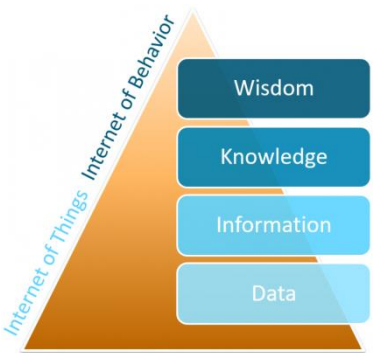
Abstract: The Internet of Behaviors (IoB) is a branch of the Internet of Things (IoT) that can develop patterns to affect people's behavior. It is a combination of three fields: technology, data analytics, and behavioral psychology. With its ability to impact consumer behavior, the combination of IoT and IoB is incredibly powerful, and digital marketing might take use of this. The most obvious and effective examples of capitalizing on the Internet of Behaviors are Face book and Google, which provide adverts to surfers at regular intervals based on detailed analysis and understanding gained from customer behavioral data obtained on a regular basis. Businesses have already begun to integrate IoT and IoB technologies into their operations. The simple explanation is that in order to thrive in this competitive industry, businesses must use agile technology. Furthermore, IoB assists in finding the major influencing variables of a client's purchasing process by evaluating consumer behavior. This technology will totally alter a customer's purchasing habits and has the ability to impact the future of purchasing.

IndexTerms **- Internet of Things (IoT), Internet of Behavior (IoB), intelligent systems, Customer behavior, Behavior-Driven software development**

INTRODUCTION

The Internet of Things (IoT) is a concept that most Engineers are aware with these days. The extent of its intricacy is continually increasing and developing. As a result of this progression, a new developing technology known as the Internet of Behavior has emerged (IoB). So it's important to know about IoT before going deeply into IoB.

The Internet of Things (IoT) is a network of interconnected physical devices that use the Internet to collect and distribute data and information. An IoT ecosystem consists of web-enabled intelligent devices that use embedded systems such as processors, sensors, and communication equipment to acquire, send, and act on data from their surroundings. The Internet of Behaviors (IoB) is a collection of data (BI, Big Data, CDPs, etc.) that gives important insight into customer behavior, interests, and preferences (IoB). The Internet of Things (IoT) extension of IoB focuses on obtaining, processing, and analyzing the "digital dust" of people's daily activities. The Internet of Things (IoT) is a network of interconnected physical objects that collect and exchange data via the internet. This data is analyzed by IoB in connection with specific human behaviors, such as shopping patterns and demographic preferences. Gartner is credited with coining the term "IoB," which is discussed in Gartner's "Top Strategic Technology Trends for 2021." Gartner credits Göte Nymanof, a psychology professor at the University of Helsinki, with the notion of leveraging IoT data to affect behavior. The IoB attempts to grasp data obtained from users' online actions from the perspective of behavioral psychology. It seeks to solve the question of how to understand data and how to use that information to the development and promotion of new products, all from the standpoint of human psychology.



LITERATURE REVIEW

This Literature survey offers the review of literature on Internet of Behavior (IoB).

Internet of Behaviors (IoB) and its role in customer services

The authors, Mohd Javaid, Abid Haleema, Ravi Pratap Singh, Shanay Rab and Rajiv Suman , discuss how IoB can be useful for business and customer services. They point out the fact that from the view point of human psychology IoB collects data, process them, construct models from these data and uses these information to promote products and boost business and improves customer satisfaction. The world is daily improving and developing. Matching the needs of customers is important to stay put in the market for a product. For this, understanding needs of customers is needed and IoB is helpful in this. Companies are constantly battling with one another for their customers' trust. Companies will use IoB to meet the demands of their customers by using data, information, and behavioral patterns. Our social media activity, Smartphone geo-location data, credit card purchases, and even culinary choices can all be sources of data. When additional information about our behavioral patterns and preferences can be gained from our everyday behaviors, the IoB will collect more data. Interpretation of this data may provide interested parties with a significantly more precise understanding of people's behavior than was previously feasible, allowing them to use it for a variety of purposes.

Internet of Behavior (IoB): A Survey

This paper by Aayush Halgekar, Aryan Chouhan, Ishaan Khetan, Jay Bhatia, Nemil Shah and Kriti Srivastava discusses the Internet of Behavior. The technology is used to study, anticipate, and influence consumer behavioral trends in order to materialize a specific commercial outcome through analysis of data acquired through tracking and identification technologies, wired and wireless sensor networks, and so on. As a result, IoB brings together elements of behavioral analysis, electronics, data analysis, and computational intelligence. As a result, this poll will be useful to people who want to learn more about IoB and its peculiarities, as well as contribute to its growth. The current state of IoB technology is discussed, as well as how IoB differs from other IoT technologies.

Determinants of Internet Buying Behavior in India

The purpose of this study, conducted by Ruchi Nayyar and S. Gupta, is to provide insight into the various demographic and psychographic factors that influence consumers' willingness to buy online. Internet penetration in India has increased due to simple payment methods, lower hardware costs, faster and more cost-effective internet communication, and dependable technology. Emailing, e-banking, e-gaming, and travel and entertainment bookings have all become commonplace among India's growing tech population. Although new business models focused on e-retailing are providing exciting services to meet the demands of e-consumers, the Indian internet retail market is falling far short of its expected potential.

The Internet-of-Behavior as Organizational Transformation Space with Choreographic Intelligence

Christian Stary is the author of this paper. The Internet-of-Behavior (IoB) is the next phase of Internet-of-Things (IoT). The dynamic development of behavior (prescriptions) based on substantial data analytics is its defining feature. Although this can be advantageous for fast adaptation, competent representation and educated design capabilities are required to comprehend its influence on persons and the embodiment in organizational structures. This paper implements the IoB notion as a continuous transformation space. Its foundation is made up of behavior encapsulations that express organizational intelligence through choreographic interactions. The basis of transformation is the description of role- or task-specific behavior as part of reciprocal interaction patterns to attain a shared goal. Following value-based interaction analysis, refinements of behavior encapsulations and interactions to executable processes are made. The level of granularity chosen defines the extent to which an organization's operational intelligence may be deconstructed or reassembled and augmented with additional intelligence. Because of its design-integrated engineering character, the suggested design-science approach might be institutionalized for continual change.

Designing Internet of Behaviors Systems

Mahyar T. Moghaddam, Henry Muccini, Julie Dugdale and Mikkel Baun Kjærgaard conducted a study and explained the innovative notion using an IoB model developed through collaboration with software engineers, human-computer interaction scientists, social scientists, and cognitive scientists. The IoB model is based on an exploratory research that combines cutting-edge analysis and expert interviews. The design of a genuine industry 4.0 manufacturing infrastructure aids in the explanation of the IoB model and its implementation. The conceptual model was utilized to effectively develop a socio-technical infrastructure for a crowd monitoring and queue management system at Florence's Uffizi Galleries. The project, which began in the fall of 2016 and ended in the fall of 2018, employed a data-driven strategy to input real-time sensory data to the system. It also includes prediction models on visitors' movement habits. The major goal of the system was to capture human behavior, model it, and create a mechanism that takes into account changes, adjusts in real-time, and continually learns from recurrent activities. Aside from the conceptual model and the real-world evaluation, this article offers professional advice and future directions for IoB to become a significant technical progress in the next years.

PROBLEM STATEMENT

Currently behavior of a person is considered a less valuable information. But analyzing a person's behavior and predicting his/her character, mood, behavior etc can help build a better business as well helps the technology to grow a lot by sharing necessary

information easily. Existing Internet of behavior when combined with this statistical analysis of behaviors can create a great change in the field of technology.

One of the major disadvantages of IoT is providing better customer care services. This problem can be overcome by combining IoB with IoT. IoB uses the analyzed behavioral data to decide the best fit results suited for each customer separately. It also opens more business opportunities as well as marketing scopes. It increases business competitions and helps in bringing quality products and services to the consumers.

OBJECTIVES:

1) It aims to record, analyse, comprehend, and respond to all forms of human behaviours in a way that permits tracking and interpretation of such behaviours utilising developing technology advancements and advances in machine learning algorithms. People's behaviour is monitored, and incentives or disincentives are used to persuade people to perform in accordance with a set of operational criteria. What is most important about IoB is that it is proactive as well as descriptive (analysing behaviour).

2) Finds how the behaviour can be combined with IoT to enable more sophisticated technological advancements.

METHODOLOGY:

1) WORKING OF IoB

a. How Data Is Collected?

Consumer data may be collected from a variety of sources, including a firm's site, social media accounts, sensors, telematics, beacons, wearable technology (like Fitbit), as well as a variety of other devices.

Each of these websites collects different sorts of information. A website, for example, may keep count of how many times a user views a particular page or even how long they stay on it. Furthermore, telematics can monitor how hard a driver brakes or perhaps the vehicle's average speed.

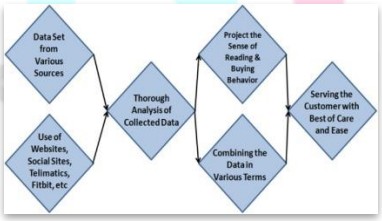
b. What Happens to the Information Gathered?

Businesses collect and analyses data for a variety of purposes. Among these goals include assisting firms with strategic choices, customizing marketing tactics, producing goods or services, and driving user experience design.

Companies create standards to aid with data analysis. When a user takes a certain action or actions, the firm begins to encourage the user to modify their behavior. If a consumer visits a company's website selling men's slim pants three times, the digital shop may show them a pop-up ad offering them 25% off a pair of jeans.

c. Using Data from a Variety of Sources

The integration and assessment of data from many sources in order to make a decision is another component of the Internet of Behaviors. Companies may construct extensive user profiles for each user by combining data from several sources. These profiles can then be scrutinised in order to establish the best course of action for the individual.
On the brand's Instagram page, for example, a client named Jerry comments on a snap of a new sneaker. Ted returns to the brand's website a few days later and looks at the same sneaker. Jerry is viewing a shoe advertisement on YouTube after a week. Meanwhile, the brand is tracking all of Jerry's digital content touch points. Because Jerry has indicated interest in the brand's shoe, the company may utilize this information to create a strategy for turning Jerry into a customer. Examples of activities the brand may do include remarketing digital ads or emailing Jerry a discount voucher.



working processes of IoB

2) BENEFITS OF IoB

The following are some of the Benefits of IoB:

2.1 IoB Benefits for Sales:

- Using behavioral knowledge, you can convert a larger percentage of leads into sales.

- Improve sales team efficiency by monitoring sales personnel behavior.
- Change the way sales interacts with customers in real time.

2.2 IoB Benefits for Marketing:

- Analyze campaign efficacy using contact behavioral data.
- Optimize marketing efforts and more effectively promote to customers.
- Use IoB data from many platforms to better understand client purchasing behaviors, such as where and when they shop.
- Trigger real-time marketing notifications based on activity data across several marketing channels and points of sale.

2.3 IoB Benefits for Customer Experience:

- Improve user experiences based on behavior feedback.
- Increase client satisfaction by responding properly to behavioral clues.
- Create settings in which everything is adjusted in real time to user behavior and preferences.

2.4 IoB Benefits for Production & Services:

- Analyze behavioral data to estimate product demand and modify production appropriately.
- Obtain previously inaccessible information on how prospects and customers engage with your company, goods, and services.
- Analyze employee behavior to enhance production and service department quality and efficiency.
- Customers' and employees' conduct should be monitored in order to promote public health and safety.
- Transform IoT data into IoB knowledge.

3) USE OF IoB IN VARIOUS SECTORS :

3.1 IoB in Business

A wide range of businesses are increasingly using online advertising to reach out to their customers. With the aid of IoB, they may identify and target certain individuals or groups that could benefit from their products or services. Google and Face book both use behavioral data to provide adverts to people on their own websites. This allows businesses to communicate with their target consumers and track their behavior in response to adverts using "click rates."

Likewise, YouTube use behavioral analytics to improve the viewer's experience by only recommending or emphasizing videos and topics that they are interested in.

3.2 IoB During the Covid-19 Pandemic

The outbreak has made us more conscious of the safeguards we must take at this time. Employers may utilize sensors or RFID tags to detect anomalies in adherence to safety regulations. Restaurants and food delivery apps, for example, use protocol data to inform their selections. For example, Swiggy and Zomato both displayed and encouraged restaurant safety procedures. They also recorded and aired the delivery person's temperature to reassure customers that they were safe.

3.3 IoB for the Insurance Industry

IoB might be very useful in the insurance market. Insurance firms such as Allstate and StateFarm already employ driver monitoring software to monitor and secure a motorist's behavior. They can use IoB to examine the behavior and establish if a certain incident was an accident or a miscalculated assumption on the side of the insured. This can help prevent drunk driving, drugged driving, and even underage or retired drivers from getting in a car and causing an accident.

Besides above mentioned sectors, IoB is also useful to other functionalities such as:

1. Location Tracking and Consumer Behavior
2. Facial Detection and Physical Status
3. Health Monitoring for Patient Recovery
4. Social Credit Score System and Tracking Citizen Behavior
5. Chronic Disease Tracking
6. Travel Booking
7. Car Insurance Premium Pricing
8. Long Term Financial Goals

4) IoB USE CASES

4.1 You may determine if someone has visited a beauty salon or a grocery by tracking their physical position, as well as the length of their stay. Businesses may use marketing messaging, special offers, and discounts to promote sales and provide their consumers with an exceptional shopping experience.

4.2 Insurance premium reductions for drivers whose cars regularly indicate desirable braking and acceleration behaviors.

4.3 Using location services and buying history to customize a shopper's point-of-sale (PoS) promotions in real-time.

4.4 During the pandemic, many computer vision companies, began using IoB to identify whether or not a citizen was wearing a mask. In the same case, thermal fingers were used to determine people with increased body temperatures (potentially a COVID-19 case).

4.5 Returning to China's social credit score system, the country intends to assess its citizens' loyalty to the current regime through systematic data collection and analysis. This is the first time a government has planned to use behavioral analysis on this scale.

4.6 Analyzing a specific user's grocery purchases in order to tailor menu recommendations.

These are just a few of the use cases of IoB which when combined with IoT and established can be widely used in each and every possible situation to ease up the works.

5) REPERCUSSIONS OF IoB

Although it may be having a lot of advantages, still there exists certain drawbacks:

1. **Lack of Piracy :**

IoB lives on data, but it keeps users in the dark about how their information is obtained. Furthermore, there are still no adequate frameworks for data navigation and utilisation, particularly on a bigger scale. IoB data is acquired at random, with no previous authorization from users.

2. **Lack of Structure** :

Many experts believe that the Internet of Things is harmful due of its lack of structure and legality. The IoB strategy, which connects our data to our decision-making, necessitates a shift in our cultural and legal standards, which were formed before to the Internet and Big Data eras.

3. **Access to Sensitive Data :**

Cybercrime is currently at its peak and hackers can gain access to valuable client data. They also have access to property codes, delivery routes, banking codes, and other information.

It's worth noting that it's not simply the gadgets themselves. Many firms exchange (sell) data across company borders or with other subsidiaries behind the scenes. Google, Facebook, and Amazon continue to purchase software that may integrate a single app user into their whole online ecosystem—often without our knowledge. There is limited legal protection for these concerns, which pose substantial security and legal threats.

6) IoB Evolution

IoB provides cutting-edge solutions for businesses across sectors to sell their products and services, improve the quality of their offerings, and impact consumer and employee behavior. Based on the data collected, the technology enables them to add value to their customer and vendor relationships and increase their bottom lines.

Behavioral data will continue to change as long as humans do. Understanding behaviors with numbers will become an interesting component of any organization as new IoT devices emerge. Of course, IoB raises data security and privacy issues, but we will always find a solution to this problem and assure responsible data usage. IoB apps for health are available for smart phones, such as SoberTool, Noom, SmokeFree, and Health2Sync—the latter an app that helps to manage diabetes through blood glucose and activity monitoring. These types of IoB apps and systems will continue to proliferate, regardless of data privacy concerns.

According to Gartner, more than half of the worldwide total will be subject to at least one IoB initiative, whether commercial or governmental in origin, by the end of 2025. IoB, like other technical developments such as AI and machine learning, is expected to spark passionate debate over the ethics of this technology vs its good applications. According to some analysts, by 2023, 40 percent of the world's unique actions would have been recorded verbatim in order to affect their behavior through the IoB concept. By 2023, the world population will have risen to more than 3 billion people.

CONCLUSION

The Internet of Behaviors provides cutting-edge tools for businesses to promote products and services as well as influence user and employee behavior. This technology is extremely beneficial to businesses since it helps them to optimize their consumer interactions based on the data collected. Behavioral data technology is still in its early stages. However, as new IoT devices proliferate, the debate over what constitutes essential data and its ethical usage is only getting started.

The success of social networking platforms, e-commerce, digital assistants, and other sorts of technology that demand personal information demonstrates that most people will be willing to provide behavioral data as well. This paves the way for IoB to re-imagine how businesses and organizations connect with and influence people through technology.

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