HOW TO INNOVATE IN AN AUTOMOTIVE DIAGNOSTICS CENTER, COLOMBIAN CASE

Jesús Salcedo Mojica

Director of Management Postgraduate Studies at the Faculty of Business
Corporación Universitaria Minuto de Dios (UNIMINUTO)
Bogotá, Colombia

Jesus.salcedo.m@uniminuto.edu

Abstract: *According to Colombian's Transport regulation, any vehicle that travels through the Colombian national territory must perform preventive maintenance to contribute to road safety and environmental protection. Therefore, this article aims to analyze how innovation in the user experience in automotive diagnostic centers will increase the awareness of vehicle owners to perform this process correctly.*

Key Words: *Wearable, Technology, Digitization, Automotive, Internet of Things.*

Introduction

The Automotive Diagnostic Centers are inspection agencies that perform the Technical-Mechanical Review and pollutant emissions in motor vehicles in Colombia, in order to ensure road safety and environmental conservation. Vehicles normally have a life of more than 10 years. Therefore, it is essential to guarantee minimum safety levels in the circulating fleet, to mitigate or reduce the accident rate with its high economic cost and human lives. The main causes of accidents in the vehicle fleet are due to three factors: the state of the road, the human factor, and the vehicle factor.For this reason, the technical, mechanical, and pollutant emissions review was born in Colombia to improve the condition of the vehicle fleet, improve road safety conditions, and air quality, fulfilling an objective proposed to Colombia by the United Nations for the progress and development of the country. For such a reason, in Resolution 3768 of 2013, the Ministry of Transportation establishes that the Technical-Mechanical Review must be performed by the law, the criteria and tests established in the Colombian Technical Standards. Therefore, this market is regulated, diverse, and dynamic according to the time of purchase of vehicles, with many opportunities for growth and evasion at the same time, with competition that does not respect the good practices of the market and the regulation of the sector.

The main objective of the work is to try to evaluate possible wearable devices to innovate in customer service in automotive diagnostic centers and at the same time to increase awareness in relation to environmental impact. The source of information for the research was data extracted from the EMIS (Emerging Markets Information System) database.

Methodology

Using *competitive intelligence*, it was possible to recognize the market dynamics of wearable devices, focusing on their potential use to enhance the user experience, to provide the customer with a unique service that serves as a driver for customer loyalty in automotive diagnostic centers in Bogota Colombia. Therefore, the organisation of the report is divided into 2 main sections:

1. Strategy Searching using secondary sources considering the objective and scope, according to company needs.

Table 1: Planning and Search Strategy

OBJETIVE	Recognize the wearable devices market dynamics, focused on their potential use in the automotive diagnostics center, with the purpose to improve their user experience.			
SCOPE	To present relevant results related to technological and market dynamics of wearable devices available in secondary sources.			
DESCRIPTORS	✓ User experience. ✓ Wearable technologies allow through connectivity to track an action or activity.			
KEY WORDS	Wearable, Technology, Digitization, Automotive, Internet of Things.			
INFORMATION RESOURCES	Google Academic., Google, LENS.ORG, EMIS, Arizton			
QUERY SEARCH EQUATIONS	#	SOURCE	SEARCH EQUATIONS	RESULTS
	1	Google / Google Scholar	(Vehicle OR Vehicular OR Auto OR Motor OR Motors OR Car* OR Motor-Car OR Automobiles) (Preventive Maintenance) OR Maintenance OR (Commercial Systematic) OR (Preventive Maintenance) OR Inspection OR (predictive maintenance) AND (User Experience) OR (Consumer Centric)	5,940,000/ 34,200
	2	Google / Google Scholar	(Vehicle OR Vehicular OR Automotive OR auto OR Motor OR Car OR „motor-Car" OR Automobile) (Preventive AND (Maintenance OR Inspection OR Prognostics)) („User Experience" OR „Customer Centric")	7.750.000 / 16.200

2. Presentation of all the relevant information analysis, in relation to the wearable devices panorama, contributing to the company's decision making. The following is the main fields and strategies that were used to do this analysis:

Technological developments and commercial products
✓ Review of the results obtained according to search equations.
✓ Filtering search results and selection of documents considered relevant based on title, abstract and key descriptors.

✓ In-depth review of the search results considered relevant, based on the wearable devices landscape and its dynamics in the market considering the satisfaction of the company's needs. And the most prominent products

✓ Selection and comparison of the key information extracted and analyzed from the selected relevant sources

✓ Conclusions

Research Results

Wearable Technology Definition

Wearable devices refer to the set of electronic devices that are worn on some part of the body, interacting continuously with the user and with other devices, to perform a specific function. Smartwatches, sports shoes with built-in GPS, smart rings, fabrics with sensors and bracelets that monitor the state of health are some examples, among other devices of this technological genre, which are gradually becoming more and more present in the lives of people. Likewise, they are used in all types of industries such as health, automotive, logistics, IT, and telecommunications, among others [1].

On the other hand, these devices are part of a sub-segment of the Internet of Things (IoT) that uses augmented reality (AR) and virtual reality (VR) technology, which is used in the business or industrial ecosystem for different purposes such as, for example, increased productivity, improved safety, greater accuracy, and efficiency. Their functionality revolves around the connection of central databases and cloud systems, using Bluetooth, Wi-Fi, cellular telephony, Bluetooth low energy (BLE) or near field communication (NFC), thus allowing the collection of information for decision making. The following Illustration reflects the overview of wearable devices, indicating the sector, its application, functions, and main products in the light of functionality with style [2].
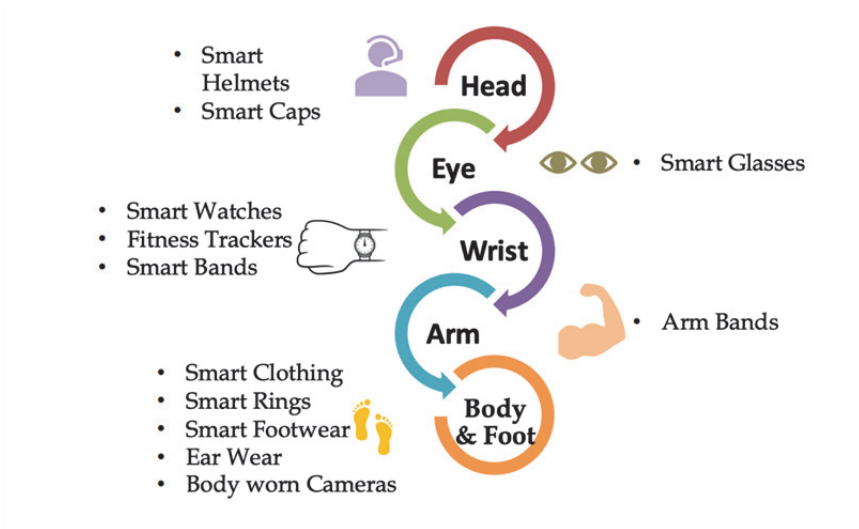
Market Segments

Wearable devices encapsulate many items that are either worn directly or freely connected to a person. Commonly, the latter comprises smartphones that have become integral to the popularity and functionality of this type of technology as it provides its users with useful aids or benefits in their daily lives.

On the other hand, the characterization of wearable device technology can be subdivided into two categories: (i) those that operate independently and function as central connectors to other devices and/or information (e.g., wrist-worn exercise tracker, smartphone) and (ii) those that capture specific actions or perform a measurement (e.g., heart rate monitor worn around the chest) and are then downloaded to a host device for analysis. In addition, these categories can include smart textiles where the physical properties of the material can measure or react to stimuli from the user or the environment. Likewise, sensors, gyroscopes, accelerometers, GPS and compasses are integral components of wearable electronics that are complemented with Wi-Fi, Bluetooth and near-field communication (NFC) to enhance connectivity with the end user, thus providing a better experience. [3]With rapid advances in technology and a focus on innovation and miniaturization, companies across all industries are looking to encourage their customers to use technology, shifting the focus from cell phones and tablets to wearable devices. Likewise, the importance and adoption of enterprise wearable devices (wearables) has been increasing due to operational excellence. With the integration of wearable devices into CRM systems, companies can gain real-time access to data, allowing them to gain insights for strategies to improve employee productivity, safety and health, as well as customer

satisfaction. This is also reshaping the understanding of employees in the workplace and is helping to drive investments and developments in different technologies such as the internet of things (IoT), augmented and virtual reality. Companies such as Adobe, Barclays and BP are providing wearable fitness trackers to create a healthier workspace. They typically help with heart rate monitoring, activity distance, step count and sleep patterns.

Illustration 1. Common Wearables at Workplaces

Source: https://www.arizton.com/

Market Segmentation by Product Type
- ✓ *Wrist Wear:* This includes smartwatches, fitness trackers, wrist bands, and fit bands
- ✓ *Eye Wear:* The segment consists of smart glasses and other eye wears that use AR and VR technology
- ✓ *Arm Wear:* This includes arm bands, arm sensors worn on the arm, shoulder or elbow
- ✓ *Head Wear:* This includes products such as smart caps, smart helmets, and head bands
- ✓ *Others:* This includes products such as smart clothing, smart rings, exoskeletons, footwear, exoskeletons, body worn cameras, and ear plug ins.

Market Segmentation by End User
- ✓ *Healthcare:* This includes wearable devices used for patients, employees, and medical professionals in healthcare enterprises, hospitals, clinics, and medical centers.
- ✓ *IT & Telecom:* This includes firms and IT enterprises using wearable devices.
- ✓ *Logistics & Warehousing:* This includes devices used for handling, material stocking, monitoring, managing inventory in logistics and warehousing enterprises.
- ✓ *Retail:* This includes wearables used for employee management, enhancing productivity, and driving operational excellence in the retail enterprise and firms to improve the customer experience

- ✓ *Oil & Gas, Mining:* This includes wearables, especially eye wear, wrist wear, and smart clothing used for remote guidance and real-time communication in the fields to improve safety in oil, gas, and mining.
- ✓ *Automotive:* This includes automotive industries that use wearables to promote accuracy and reduce the margin of errors, thereby improving productivity.
- ✓ *Transportation & Hospitality:* This includes wearables used by drivers, hotels, and restaurants to improve order management and increase safety of the employees, to improve customer experience.
- ✓ *Construction:* This includes construction sites using wearables to enhance employee safety and reduce accidents.
- ✓ *Others:* This includes industries such as government, defence, military, public safety, police, and education enterprises using wearables for security, welfare, and personnel training.

Market Segmentation by Connectivity

- ✓ *Wi-Fi:* This includes wearables connected to the database using Wi-Fi as a base and primary mode of connectivity despite the presence of other options such as NFC, Cellular and Bluetooth
- ✓ *Bluetooth:* This includes wearables such as smartwatches and fitness trackers that use Bluetooth and BLE as the basic mode of connectivity
- ✓ *Cellular & NFC:* This includes wearables that use cellular, LTE, and NFC mode of connectivity that is more ideal for the end use applications.

Market Insights[4]

Market Opportunities& Trends	***Bring Your Own Wearable (BYOW):*** In the future, it is more likely to see most employees using their personal devices and smart wearables for professional purposes. **Growth In Smart Clothing:** Smart clothing, which have hardware and implanted sensors, will be the future of wearable technology in enterprises. Most clothing can connect to the database, smartphone or an application through Bluetooth or Wi-Fi, which enhances working level in job sites.
Market Enablers	**Need For Tracking Workplace Wellness:** The safety and wellness of an employee are the key criteria for maintaining a satisfied workforce in an enterprise. A healthy employee is more productive than the unhealthy one.

	Growth In Wearable Technology Solutions: One of the major reasons for the adoption of enterprise wearables is the development of software and solution providers that offer exclusive analytics and monitoring features that are more specific and customized to the industries. **Rise In Adoption of IoT In Enterprises:** The Internet of Things (IoT) is a gamechanger in the era of technology as it has served as a tool of success and improvement in a wide range of industries.
Market Restraints	**Data Privacy and Security in Workplace:** Wearable devices can communicate with the devices in the ecosystem, without compromising on the safety and security features. For instance, when the wearables communicate with the other trusted devices in the ecosystem, they identify and validate the wearable, and automatically unlock them in the vicinity. These devices are locked down when the wearables are not in the appropriate zone. **High Cost of Wearables:** The high cost of the product is estimated to be one of the challenges that prevents the adoption. **Safety Regulations In The Wearable Technology:** Wearable devices and smartphones in the enterprises are used extensively for enhancing the performance and sharing information through real-time monitoring. Most wearable devices associated with the healthcare industry include metrics associated with the Patient Generated Health Data (PGHD). Thus, end-users in the healthcare industry are concerned about the risks associated with the misuse of data from patients and the HIPPA responsibilities that are linked with wearable devices[5].

Source: Prepared with the help Beecham Research`s Wearable Technology Application Chart. http://www.beechamresearch.com

Technological Developments

Illustration 2. Mapping of Jurisdictions where patents related to wearable devices have been granted.
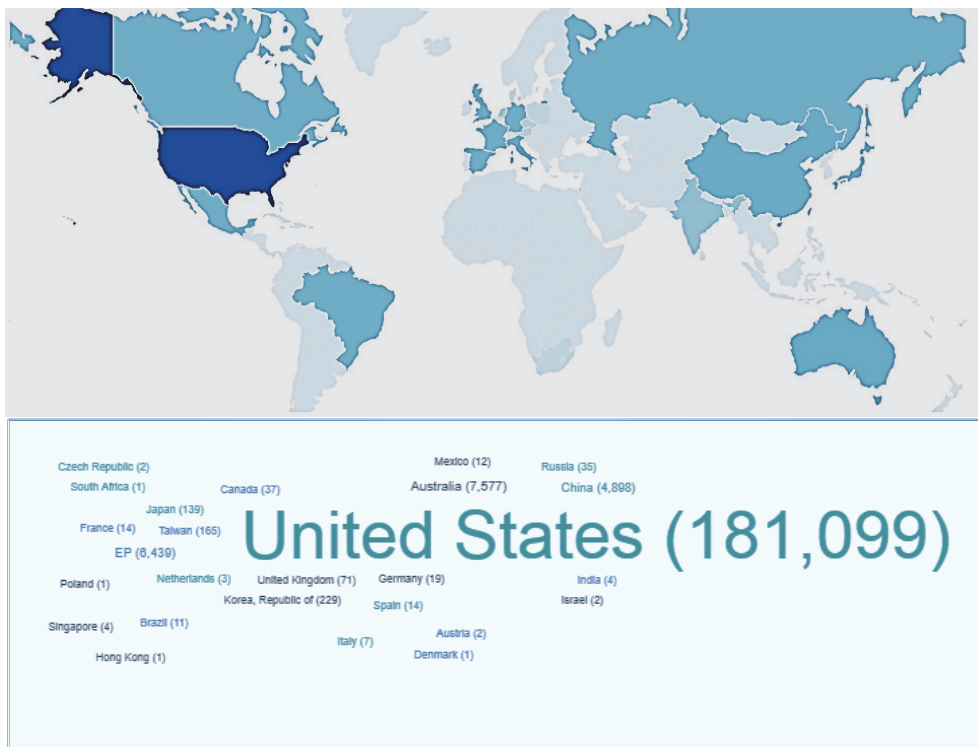
Source: (Prepared with the help of www.lens.org)

Illustration 2 shows the dynamics of technological developments (from 1976 to 2020) from a global approach, which reflects the application of patents related to wearable devices. In total, 200,786 applications have been made in 26 jurisdictions, where the top 10 are: United States (181,099), Australia (7,577), the European Patent Office (6,439), China (4,898), South Korea (229), Taiwan (1659), Japan (139), United Kingdom (71), Canada (37), and Russia (35).

Illustration 3: Mapping of the Top 10 companies out of the top 100 that have applied for patents related to wearable devices -wearables
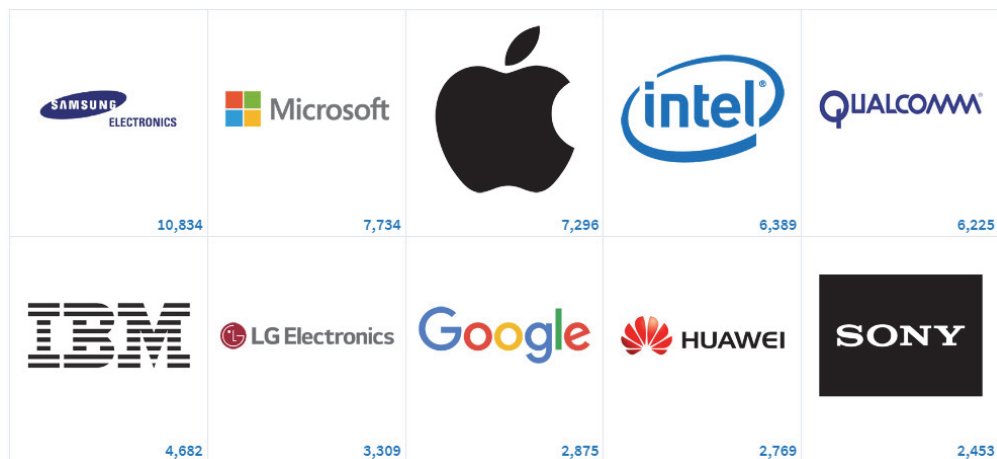
Source: (Prepared with the help of www.lens.org)

Conclusions

- Organizations consider wearable devices (wearables) as a source of strategy for business success. Their use contributes to value generation in the long term, improving their competitive position in the market. In the case of the automotive maintenance sector, this technology will allow it to deliver a better customer experience, positively impacting customer loyalty.
- Smart wearable devices such as glasses, watches, bracelets or armbands and cameras attached to the body are perceived as very useful and powerful applications in the workplace as they allow the user to perform their functions without distractions or interference. Therefore, for the Automotive Diagnostic Centers (CAD) sector, this technological accessory would be ideal, since, in their processes, employees require a significant degree of concentration.
- The main wearable device technology for the automotive industry is smart glasses, as they allow the company to monitor processes in real-time. Additionally, this accessory serves as input for the implementation of real-time training strategies.

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