The Use of Industry 4.0 Concepts in the Retailing Process of the Automotive Industry

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Abstract

The world is witnessing a tremendous breakthrough in technology owing to the use of the Internet and electronic devices. Accordingly, the relationship between companies and their customers will be closer than before. These changes will allow products' users to communicate with their manufacturers so that they can be improved in future generations and can also be supported with updates made remotely, without user intervention. Productivity increment, continuous improvement, and enhancement in customer relations are the objectives of this paradigm shift. Products from all durable and non-durable segments will have a high level of customization with the customer being responsible for specifying which characteristics will satisfy them. The current work presents concepts of Industry 4.0 and IOT (Internet of Things) and highlights the retailing process of the automotive industry. The related works are reviewed, and a solution framework is reported and discussed in details.

Keywords
Industry 4.0, IOT (Internet of Things), connected products and services, digital transformation

1. Introduction

The three industrial revolutions developed mass production, electric energy and the use of information technology and made technological competition the center of economic development [1]. The first revolution, at the end of the eighteenth century, involved the use of machines. The second revolution, around 1870, the utilization of electric energy and the third, around 1969, the use of industrial automation [1]. In the third industrial revolution, the Internet was the key factor because it was considered as a public infrastructure technology rather an exclusive technology [2]. In the fourth industrial revolution (Industry 4.0), the impact will be more exponentially intense as it is built on a set of technologies that integrate the physical, digital and biological worlds. Industry 4.0 has the potential to increase economic growth and solve some of the global challenges the world is facing.

Industry 4.0 does not exclude the previous eras of industries, but it is expected to bring immense advantages and many challenges. Nonetheless, the main challenge that most stakeholders are concerned with is the cyber- security risk which make the IoT (Internet of Things) the pillar of Industry 4.0. Furthermore, the rate

of the technological development in Industry 4.0 is exponential which make the challenges and even the benefits much more difficult than what the world faced in the previous industrial revolutions [2]. This is due to the high development of technologies that could compete with different possible distribution circumstances that may result in more frequent innovations that are difficult to predict.

One of the applications that are encountered with Industry 4.0 is automotive industry in which the transformation will turn out to be more comprehensive than it was thought [3]. The fields of mobility services and connected services will have an enormous impact on future business in conjunction with electric mobility and automated driving which render mastering the required digitization technology more important to motivate all employees of any enterprise to embrace progress [3]. In [4], the current situation trends in the automotive industry was analyzed and offered a prediction of marketing strategies 2030s. Political, environmental, social, and economic trends are changing the competition in automotive industry faced with technological change arising at an exponential rate, companies are much slower, besides, mobility services instead of vehicle ownership; increasing demand for connected services; autonomous driving; and electromobility [4]. In [5], specific challenges of the automotive industry that can be confronted using blockchain technologies were introduced for different stakeholders. For car dealers and retailers, five challenges were introduced, namely, (1) updated car ownership records, (2) updated repair and maintenance records, (3) updated purchase records, (4) lack of trust in autonomous vehicles and IoT-connected vehicles, and (5) lack of information sharing.

In this paper, we introduce a framework about using Industry 4.0 in the context of dealing and retailing services of the automotive industry. The majority of the automotive dealers are conducting the work manually, which consume a lot from the staff time and effort, starting from generating KPI [Key Performance Indicator] reports, tracking vehicles TAT [Turnaround Time], Conducting VHC [Vehicle Health Check] when vehicles arrive at the dealer and analyzing the VOC [Voice of Customer] surveys. The remainder of this paper is as follows: section 2 presents the progress of using electronics in vehicles; section 3 gives an overview about the current retailing services in automotive industry. Section 4 gives a glance about Industry 4.0; section 5 highlights the application of Industry 4.0 in automotive industry. Section 6 introduces the proposed framework.

2. Electronics and vehicles

The use of electronics in vehicles has developed the automotive world and dramatically increased the number of options available to the market. Electronics has helped to simplify the manufacturing of components and the assembly of vehicles. There are obvious technological advances in the automotive environment, ranging from keys that control the ignition to entire systems such as Anti-Lock Braking Systems (ABS) and Traction Control Systems; the growing number of electronic items caused the number of wires, modules and connections to escalate considerably [1,4]. Figure 1 illustrates the number of electronic subsystems in an automotive vehicle.

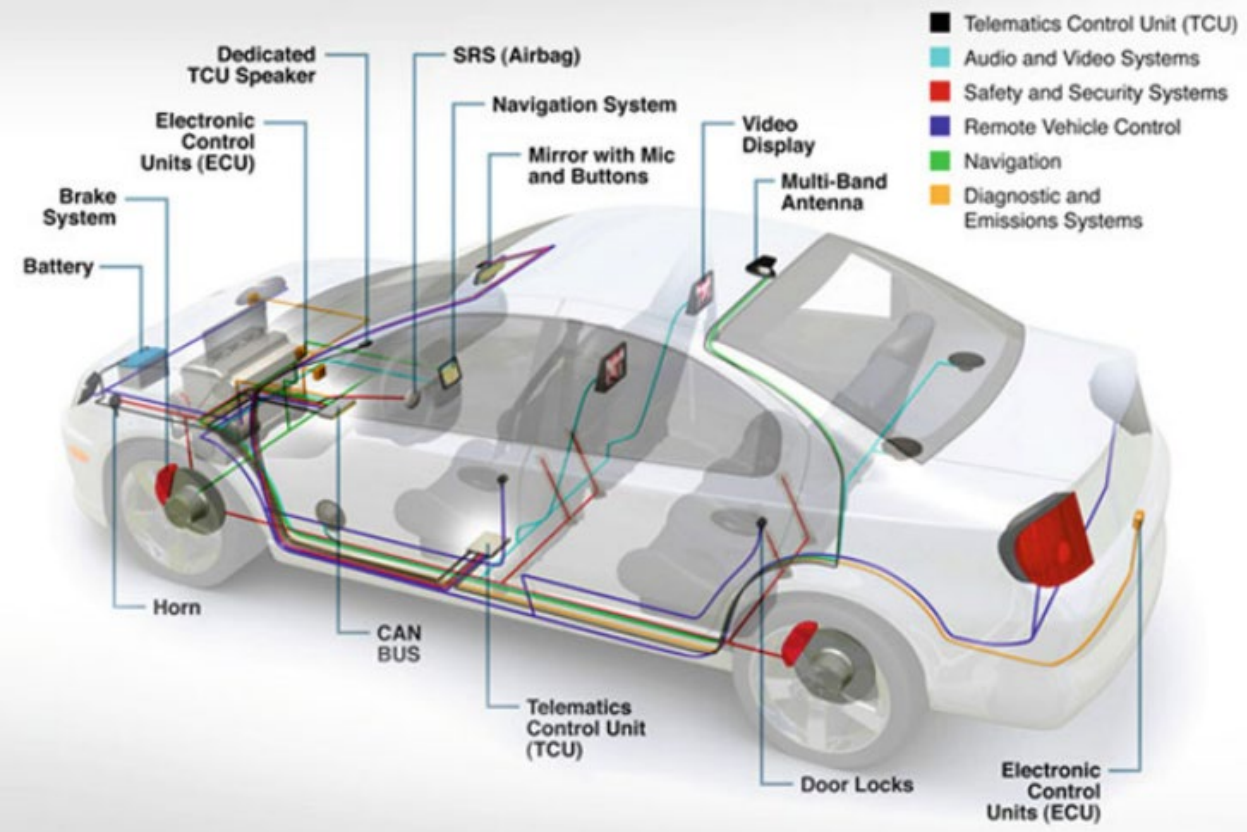

Figure 1 Subsystems of a motor vehicle [1]

All these systems are connected by a common physical way called the Controller Area Network (CAN) which manages access to functions of the vehicle. The CAN network applications were in the bus and truck sectors; currently, it's used in the automotive vehicle, ship and tractor industries. Modules that control the various vehicle systems can exchange information with each other via this network. The encoding of the information is digital, the data transmission is serial and there is a strategy of priority management in the diffusion of the information in the network. This network be utilized at the context of dealing and retailing process.

3. Overview of the current retailing system

Figure 2 depicts the current retailing system of automotive products grasped from working in a real retailing company. When driver that check the mileage, or if there is any warning light in the vehicle IPC [Instrument Panel Cluster], a visit to the dealer is required for checking. Where they receive the vehicle and do all the necessary job required after the diagnosis process; by checking the concerns provided by the driver and following the repair manual instructions to find the root cause. Finally, they provide a report that includes the repair/replace required, parts and the total amount. Based on the workshop loading, and available technicians, promised date and time given to the driver. During the repair period, the driver has no idea about the progress, unless the dealer contacted him/ her and provide the feedback or if additional part or labor is required. Finally, when the quality controller accepts the quality of the repair done, the driver will receive a call confirming that he can visit the dealer to receive his/her vehicle.

This current system has some issues; for example, we cannot predict whether the vehicle has a faulty in its function, operating system or whether it is due to the maintenance service. Moreover, the driver only decides to go to the service center according to the mileage, or if there is any warning light in the vehicle IPC.

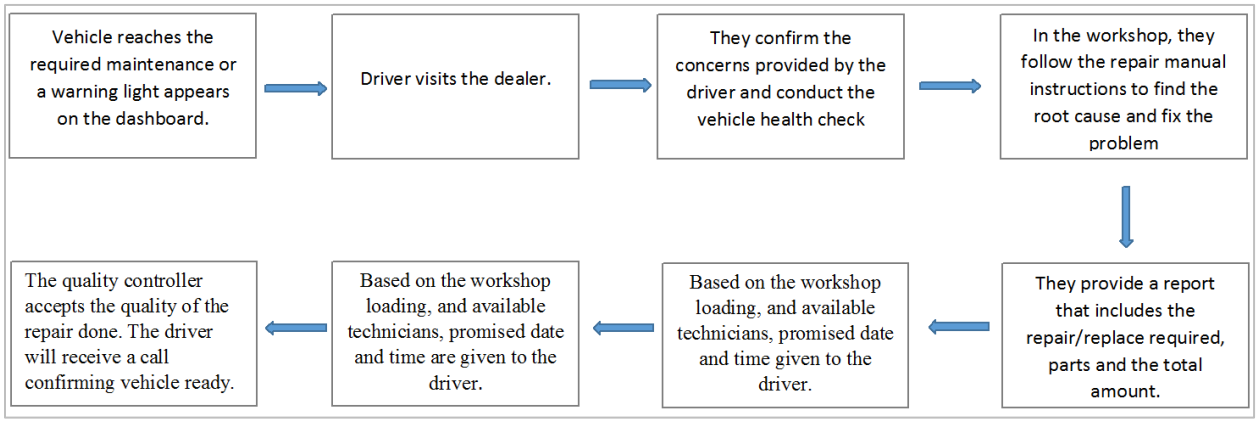

Figure 2 The current retailing process

4. Industry 4.0 concept

Industry 4.0 (The fourth industrial revolution) is a name for the current trend of automation and data exchange in manufacturing and service technologies [6]. The term Industry 4.0 appeared at the Hannover Fair in Germany in 2011; afterwards, employees from the German Academy of Sciences and Engineering conducted a study about the implementation of this industry model for the German Federal Government [1]. The study addressed the connections between machines, systems, and assets that enable industries to precisely control every step of the value chain to make their plants intelligent [1]. Some companies use different terms; for example, General Electric uses the term Industrial Internet, and Cisco describes it as the Internet of Everything which is connected with radio frequency identification (RFID) as a network of physical objects that contain embedded technology to interrelate with their internal states or the external environment. [7]. The difference between these terms and Industry 4.0 is their application; in other words, application in the industrial environment characterizes the name of Industry 4.0, whereas IoT is applied to things outside this scope [1].

Industry 4.0 is not only a technology, but also a set of Information Technology (IT) tools applied to the industrial environment to improve the production processes and achieve better quality and productivity. The main technologies as described in [1] are Additive Manufacturing, Artificial Intelligence, Internet of Things, Synthetic Biology, Cyber-physical systems, and IT. Besides, mobile devices, Big Data, Analytics and electronic elements such as sensors and actuators.

5. Industry 4.0 in Automotive Industry

Automotive industry is undergoing an extensive transformation in both its products and processes. The processes are growing more technology and hence improvement in quality and operation time using cyber-physical systems that can be integrated using computer technologies. An example of a cyber-physical

system is an intelligent assembly line, where the machines can perform several operations by consulting specifications electronically described in the component that is being manufactured, remembering that this all happens in the manufacturing process of the Prototyping using 3D printers, supported by the concept of Additive Manufacturing, also helps to reduce development costs since it is not necessary to develop corresponding tooling [1]. Likewise, the dealing and retailing process can be undergo to Industry 4.0 as it is increasingly loaded with technology. Like manufacturers, dealers can also benefit from the use of the Industry 4.0 set of technologies by capturing information from their customers and then using this information to improve their retailing process. With the use of sensors and the CAN network, the dealers can initiate a data connection, capture sensor data and use it to analyze the preferences of customers and drivers, and behavior of components and systems of the vehicle. For instance, tracking the number of kilometers travelled; checking fuel quality; remembering the geographic regions travelled; monitoring of parts that affect safety, and strong connections between manufacturers and customers through dealers.
All this information provides the manufacturer with the ability to monitor the product very precisely and even to contact the customer if necessary, in case of complaint. The information can also be used in a knowledge base for use in continuous improvement and new product development projects.

6. The Proposed Approach

Traditionally, the main information channels between the manufacturer and the customer have been through car dealers. Consequently, a lot of information about the condition of the vehicle is lost to the manufacturer. The proposed approach as shown in Figure 3 is supposed to find better ways in solving problems and come up with innovative solutions; to achieve dramatic improvements in retailing process of cars while continuously improving quality to meet rising customer expectations. First, we need to listen to the voice of customers from Industry 4.0 perspectives: by conducting surveys and interviews with them. Additionally, we need to organize brainstorming sessions with the stakeholders [Frontline staff, Administrators, Managers …etc.]. To shape the area of improvements and guarantee quality of service delivery: the degree to which a set of inherent characteristics fulfill requirements. Then analyzing the collected data using the theories for the quality and use the results from quality control process to reflect the overall quality status. Finally, we need to provide guidance and direction on how quality will be managed and verified throughout the implementation. For example, by adding to the proposed approach a feedback flow from the User/Support phase to the phases of ideation and definition, and inclusion of this information in a knowledge base. Moreover, IoT can play a fundamental role in channel integration of retailing process because it allows companies to rebalance supply and demand [8].

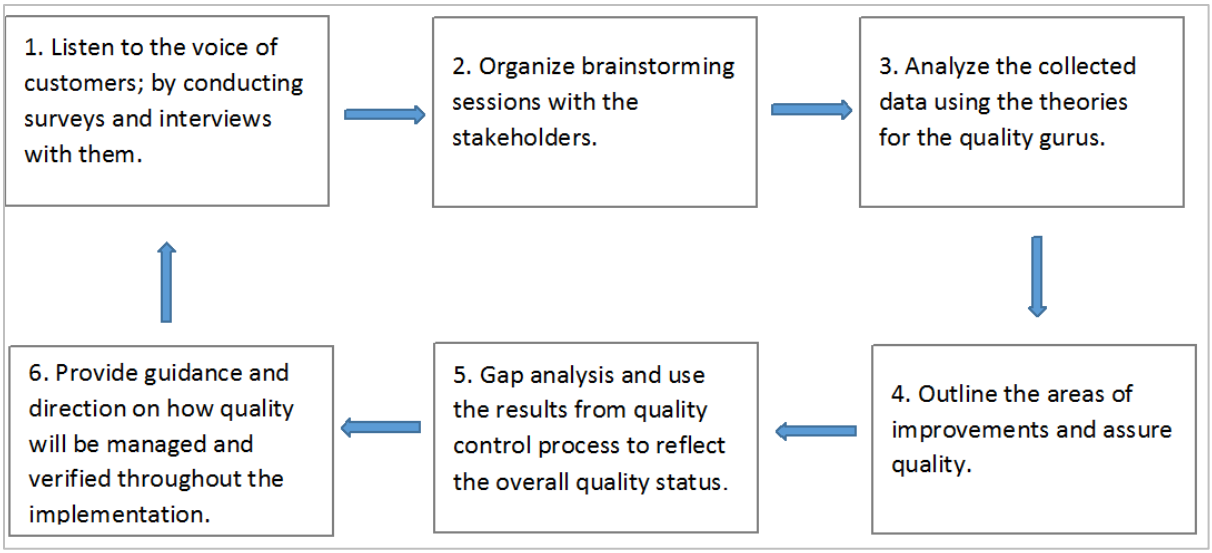

Figure 3 Framework diagram for the proposed approach

7. Conclusions

Industry 4.0 has the potential to make the retailing processes of cars more efficient and thereby enable the production of products and after sales service with high quality standards and in a very short time. Many potential benefits can be highlighted: cost reduction; increased safety; environmental conservation; error reduction; no waste; and business transparency. All the above-mentioned benefits enable the automotive industry to expand its research and development centers, encouraging the study of new technologies and their integration into existing and future product lines alongside dealing and retailing process. This paper gave a glance about the shape of the retailing process in the age of Industry 4.0. a proposed approach was introduced to address some issues in the current retailing process using IoT.

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Biographies

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