# VEHICLE CUSTOMIZATION USING AUGMENTED REALITY (AR): A LITERATURE REVIEW

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## ABSTRACT

Augmented Reality (AR) is a new technology which is enabling human beings to interact with machines. Interacting with the virtual objects and Digital information in a real world. Various applications of AR can be found in many areas of research from recent years. This study represents a systematic review of exiting AR systems in automobile industry. The main research questions are: What are the main benefits and challenges of AR for the automotive industry, Will augmented reality enter the automobile industry, where and for what purpose is AR technology applied in the automotive industry. The goal of this paper is to go through all the AR technologies which already exist in automobile field and to provide an insight into the AR applications and technologies.

Keywords: Augmented Reality, Customization.

## I.     INTRODUCTION

In many industries, implementation of modern technologies help giving edge to the competitor's in the tough global market. It propels company's innovativeness forward and can even lower the expenses required for the production and can help maximizing the profits. Automotive manufacturers have always remained at the forefront in taking advantage of the latest technological advancements. Thus, the automotive industry has experienced a significant development, mainly due to the adoption of new advanced technological improvements such as virtual mock-up and prototyping, advanced manufacturing techniques based on sophisticated robotic systems, automated vehicle safety and user-friendly interfaces for improving driving experience. In recent years, many automotive manufacturers have developed a keen interest in augmented reality (AR), mainly due to its accessibility and potential for generating innovative solutions. AR is a form of human machine interaction (HMI) in which virtual components are inserted and superimposed on the real world, creating the illusion of an 'enriched' reality. It allows users to obtain certain information they need about some aspects or procedures directly in the working environment and it has the potential to enrich a person's sensory perception. Based on Milgram's definition of a reality- virtuality continuum, AR represents a component part of mixed reality (MR), which is the merging of the real and virtual worlds. Milgram's concept of a reality- virtuality continuum is exemplified for the automotive industry in Figure 1. The applications of AR range from industrial to everyday life activities, in various domains, like manufacturing, robotics, healthcare, education, military, entertainment and so on. There are several extensive studies that address the implications and impact of AR on industry, as well as the challenges and directions of development in this field.

AR provides promising new possibilities in almost every area of the automotive industry due to its potential as an interactive and intuitive interface. The usage of AR in the automotive industry has been explored through various platforms. For instance, AR can substantially improve the user experience with head-up displays (HUDs). HUDs are display systems adapted from military aviation to convey visual information in the driver' field of vision. They are see-through devices designed to present various real-time essential information in order to increase safety. There are two ways provided through HUDs: adding information into the environment or highlighting some elements already present in the environment. One such interesting solution is to overlay a video stream over the car in front of the driver, where you can see what is in front of it .AR contributes to many

other aspects of the automotive industry, such as maintenance, repairing, diagnostics, inspection or training. AR technology has also begun to be used as a marketing tool so that customers can interactively customize their car before ordering.

## II.     LITERATURE REVIEW

While analyzing various past researches on augmented reality we found that today we can assume that the augmented reality has already entered the automobile industry. The various leading car manufacturing companies have already integrated the AR features in their production and marketing processes. The success of automotive companies directly depends on the launching of advanced technologies. In the last years, automotive industry experts agree that the near future of the automotive industry will be closely related to the use of augmented reality technology. First of all, AR can completely change the driver's user experience with the help of head-up displays (HUDs). Also, augmented reality transforms many other aspects of the automotive industry, such as showrooms, prototyping, car assembly, and maintenance. Following, we look at how leading car manufacturers use AR in the automotive sector and what benefits it brings to their businesses. In Reference 1, we found that various companies like BMW, Mercedes, and Volkswagen have launched their AR showrooms and AR applications for Real world experiences.

**BMW**

BMW was one of the first to start using AR in Automotive industry. In early 2010, they demonstrated HUD concepts. In addition, in 2016, they shoed BMW vision next 100 – the prototype of windscreen head up display using AR and AI. In 2017, BMW launched its first virtual showroom. It was an AR app for smartphone, in which buyers could have close look of their car models and get a unique interactions.

**Mercedes**

Mercedes used AR to support the loyalty of their customers with the help of virtual assistant - Ask Mercedes. It is free IOS AR application in the form of instructional and manuals. Ask Mercedes helps car owners to learn more about their Mercedes auto capabilities and their use. Moreover, in January 2018, Mercedes introduced the new progressive infotainment system MBUX, which uses AR and AI. The AR system is only available in Mercedes- BENZ A- Class cars.

**Volkswagen**

With the growing complexity of modern cars, even certified auto mechanics need help to deal with them. Therefore, Volkswagen has created the MARTA app for their service departments. This interactive AR app helps technical workers to perform car maintenance much faster. Volkswagen also uses spatial AR for vehicle design. With the projectors, designers overlay appropriate AR images on physical car models. Thus it's easy to evaluate various design options and immediately make the necessary adjustments.

Reference 2 gave the information about how AR is integrated in various automobile field. Therefore the research questions are following:

Where AR technology applied in the automotive industry?

What are the main benefits of AR automobile industry?

Digital car showrooms will change how drivers buy vehicles. Today, you don't need to visit brick and mortar showroom to examine a car. It is enough to install the AR app on your smartphone. For example, in 2018, Porsche launched the "Mission E Augmented Reality" app, which can be used free on IOS and Android smartphones. The company uses this AR application to promote its electronic sports cars. In the "Explore" mode, users of AR app can learn about the concept and consider the design of the car with 3D visualization. And in the "Drive" mode, users can get an exciting, immersive test drive in augmented reality You can also use augmented reality to enrich the interaction with the car in the showroom following the example of Honda .At the Detroit Auto Show 2018, Honda demonstrated a unique Honda Lens project using augmented reality technology. This is a tour with the help of AR smart glasses, which turns the boring viewing a car into a memorable experience.

Augmented reality has an extensive practical application in the automotive industry, serving both drivers and car manufacturers. Augmented reality apps help customers to pick cars. AR integration into automobile equipment makes driving safer. Digital AR manuals allow users to self-maintain a car, even if they know nothing

about machines. Automotive companies also use AR in automobile manufacturing. With the help of augmented reality, they optimize the processes of prototyping and assembling cars. AR also helps auto mechanics to repair vehicles quickly and accurately. Augmented reality can benefit your automotive company as well. AR technology is already in the assembly, Design, Maintenance, Manufacturing in various automotive applications.

**Benefits of AR Systems**

The main areas of the automotive industry in which AR studies have been conducted include the improvement of driver safety, the improvement of product design performance and manufacturing operations and higher quality training for assembly and maintenance. The main benefits were classified in four categories (i.e., better training, enhanced safety conditions, performance improvement, and faster execution of activities).

## III.    METHODOLOGY

To find relevant literature sources, well-known online research related to AR 'Applied Science' open access journal is used.  And for getting the information about AR applications in automotive industry we used article by Anastasia Morozova (Chief Operating Officer).

How to make the AR for vehicle customization, the applications which can be remotely accessed by the user or the customer where the user is able to control the physical appearance of a car trough mobile app. Physical appearance include body color customization, door handles, head/ tail lights, rims. The next main focus is on the user should also be able to view the specifications of particular part he is tapping on, means if the user selects the rim , the screen will display the several specifications like its dimensions and material used.

## IV.    CONCLUSION

The Goal of this study is to present, through a systematical approach, How AR can be useful in automobile industry. There are more applications and systems in this field and this effort tries to address some research questions in order to provide useful findings for future research and to complement previous AR review studies.

A remotely accessible AR application which helps user to customize his car according to his preferences can bring new era in vehicle sales marketing field.

In the future, we intend to explore more deeply the individual application fields in the automotive industry. In this regard, we should try to identify the trends that are emerging in terms of AR implementation as this technology goes to the highest level of maturation.

## ACKNOWLEDGEMENT

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