Industrial design process in view of artificial intelligence

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Abstract:

In view of the fourth industrial revolution that changed the features of the world, the field of artificial intelligence penetrated several fields, including human resource management, e-commerce, manufacturing, self-driving cars, and many others. As it became part of our daily life through dealing with our mobile phones, driving our cars, manufacturing and using many devices, and also building and using our smart homes, in addition to advertising designers and architects who used it in performing their work. This indicates the spread of the use of artificial intelligence, and predicts an increase in this spread in the near future.

All applied sciences are under continuous development, due to the development that the world is witnessing in all areas of life that directly and indirectly affect those sciences. In particular, the field of industrial design, which is closely related to many areas of application of artificial intelligence; Which prompted industrial design professionals to study and track its development; This is in order to perfect the design of the products that depend on it in its operation and use.

By studying artificial intelligence and its patterns, its working procedures and making decisions, and predicting the results and developments related to the data and events presented to it; It turns out that it can play an active role in most stages of the industrial design process.

The research followed the inferential approach, as it reached to codify the role of artificial intelligence in reformulating and practicing the stages of the industrial design process. And that is through developing a proposed concept for an artificial intelligence system that is considered as an assistant to the industrial designer in performing his work, based primarily on the application of different types of artificial intelligence - depending on its objectives and capabilities - in practicing the stages of the industrial design process.

Keywords:

Artificial Intelligence, Industrial Design, Machine Learning.

Problem of the study:

In light of the fourth industrial revolution that changed the features of the world, and the remarkable development in the fields of software, electronics and information technology; The field of artificial intelligence has penetrated several fields, including industry, medicine, space and others, as self-driving cars, smart homes, robots with multiple capabilities and specializations, and many other applications have appeared to the world.

Advertising designers and architects have also begun to use artificial intelligence to do their work. Which invites us industrial designers to study how to benefit from it in improving our work performance and results, not only keeping up with the pace of progress, but also seeking to advance our specialization. In order to provide products that meet the aspirations of mankind after fulfilling all their needs.

DOI: 10.21608/mjaf.2020.38503.1797

Significance of the study:

The importance of research is to develop a clear vision to benefit from the specialization of artificial intelligence in the practice of the industrial design process; This saves a lot of time and effort and ensures the completion of the process as efficiently as possible, reaching the best results and providing innovative designs for high-value products that serve humanity and meet its ever-changing needs.

Objective of the study:

The research aims to legalize the role of artificial intelligence in reformulating and practicing the stages of the industrial design process.

Methodology of the study:

The research follows the explanatory method.

Statement of the study:

Despite the penetration of artificial intelligence into many fields, and providing solutions that would change the face of life, replace humans with machines, and at the same time reach the best results, as is the case in manufacturing automation, some educational methods, and social media, but there is still Many tasks artificial intelligence could not control: chiefly creativity, which is unique to humans.

Several studies have been conducted in this regard, and the effect was that by 2037, 47% of the tasks that humans accomplished will be replaced by machines, but the innovators are not among them, as the probability that they will be replaced by robots is only 8.2%.

Despite this, some creative majors have already used artificial intelligence techniques to accomplish some of their regular, repetitive tasks. Like architects, and advertising designers.

Likewise, industrial designers can take advantage of artificial intelligence techniques to facilitate their work and accomplish non-creative tasks with the help of these technologies, in order to save time and effort to complete the creative processes of innovation and development with the required efficiency.

Results of the study:

The role of artificial intelligence has been codified in the reformulation and practice of the stages of the industrial design process, where it is proposed to build an artificial intelligence system that helps the designer complete the stages of the design process with the same efficiency as usual, or more, while saving time, effort and money.

So that the application of that system is suitable in different design processes for products from the same family, and it is characterized by continuous learning, which makes it self-developed and improves its performance; Hence its results; Which makes it constantly evolving.

It is worth noting that the industrial designer must participate as a member of the system building team as an expert in the relevant field.

The following is a presentation of that proposed scenario to illustrate how to make use of artificial intelligence techniques in completing the stages of the industrial design process:

Stages of the industrial design process in light of artificial intelligence:

1- Brief design project (goal setting) Brief:

- Stage details: The aim of this stage is to identify and understand the problem under study; And then choose the product that will be created or developed to solve that problem. To complete this successfully, it is necessary to collect as much information as possible about customer desires, competing products, recent trends in the field, available technology, promising markets, and also stand on the company's strategy and the resources available to it.
- The role of artificial intelligence: Artificial intelligence can provide assistance to complete this stage with less effort and time, by using a set of its patterns that are combined together to produce an effective artificial intelligence system, and these patterns are:

○ Personalization The Hyperpersonalization Pattern: It provides comprehensive information on the relevant markets, competing products, available technology, and customer desires.

○ Determining stereotypical and atypical values Predictive Analytics & Decision Support: which provides searching for references related to the existing process, and it also identifies recurring patterns in the products available in the market; And then it helps in identifying the recurring problem with it, and also realizes the frequency of inquiring about a product that performs a specific function; This explains the need for the availability of that product.

○ Predictive Analytics and Decision Support Identifying Patterns and Anomalies: This pattern helps in nominating the best decision for choosing the product to be innovated or developed, and it also helps predict sales.

○ The recognition pattern: which provides specific information on the capabilities of the institution and its available resources, as it provides all information on the solutions to the problem under study.

2- Research:

- Stage details: During this stage, markets are searched for related products that are similar to the product under design process, in order to adhere to the intellectual property rights of others. And also to study and analyze similar products to be used in the design process.
- The role of artificial intelligence: Using a group of artificial intelligence patterns combined together, this stage can be completed with less effort and time, and these patterns are:

○ Personalization The Hyperpersonalization Pattern: which provides information on the target group of users, whose specifications are determined by the work team. This pattern shows the users' preferences in terms of products, designs, technology, prices, colors, and other information.

○ Determining stereotypical and atypical values Predictive Analytics & Decision Support: which provides search for references related to the existing design process, as it identifies recurring patterns in competing products, such as colors, design lines, technology used, and other recurring features.

○ The recognition pattern: it provides comprehensive information about similar products and their parts, raw materials, prices, technology used in them, available colors, defective parts if any, and other specifications.

3- Design Specification:

- Stage Details: During this stage, the available information is analyzed, and design requirements are developed; Which helps turn the product into reality. These are functional, usability, sexual, productivity, environmental, economic and aesthetic requirements.
- The role of artificial intelligence: During this stage, a group of artificial intelligence patterns are combined together to complete the activities of the stage with the least time and effort, and the best possible efficiency, and the information extracted from the previous two stages is the input of that stage, and the patterns used are:

○ Determining the typical and atypical values of Predictive Analytics & Decision Support: which identifies recurring patterns in the results of the previous two stages, as it detects the repetition of elements in similar products and the desires of the users; Based on that redundancy and compatibility with the basic science involved in the product being designed; Design requirements are established.

○ Predictive Analytics and Decision Support Identifying Patterns and Anomalies: This pattern helps in filtering the best decisions from among the available information from the previous two phases to select and define design requirements.

○ The Recognition Pattern: which provides the standard form of design requirements on which to base the requirements.

4- Plan:

- Stage details: In this stage, a summary Outline chart of what the product must be in order to perform its function and its usability is made.
- The role of artificial intelligence: During this stage, two types of artificial intelligence are relied upon, combined together to complete the activities of the stage with the least time and effort and the best possible efficiency, and those patterns are:

○ The Goal-Driven Systems Pattern This pattern helps to ensure that the proposed scheme achieves the desired goal.

○ o The Recognition Pattern: which provides all the data and information required to create a brief diagram of the product and how it performs its function, as well as how to use it.

5- Design:

- Stage details: In this stage, design ideas are established and developed, until detailed product ideas are reached that achieve the desired goal, and the design documents for them are completed.
- The role of artificial intelligence: Artificial intelligence can provide assistance to complete this stage with less effort and time, by using a set of its patterns that are combined together to produce an effective artificial intelligence system, and these patterns are:

○ Pattern of systems that follow the goal: The Goal-Driven Systems Pattern, as this pattern helps to ensure that the proposed ideas achieve the desired goal, and also in the case of interactive design, it helps to verify the effectiveness of the use scenario.

○ The recognition pattern: This pattern helps when completing design documents to perceive and use similar details in the database.

○ Autonomous systems pattern: Autonomous systems help in completing design documents, which start with manual drawings, data and some simple engineering drawings. Autonomous systems transform them into complete, coordinated design documents suitable for building a prototype.

6- Test:

- Stage details: During this stage, prototypes of the ideas are built, to be tested to ensure that they perform the desired function and are suitable for safe use by presenting them to a sample of users.
- The role of artificial intelligence: Artificial intelligence can provide assistance to complete this stage with less effort and time, by using a set of its patterns that are combined together to produce an effective artificial intelligence system, and these patterns are:

○ Autonomous systems pattern: This pattern helps in converting design documents into prototypes of the chosen group of ideas, and it also helps in conducting tests on these models using virtual reality technology, and identifying their shortcomings and most important features.
○ The Goal-Driven Systems Pattern, which makes sure that the prototypes achieve the intended target successfully. In the event that the product is an interactive design product, you make sure of the correctness of the use scenario.
○ The Conversational Pattern: This pattern helps to build a chat program to interact with users and learn their opinions about the prototypes, and also realize their feelings about user experiences.
○ The Hyperpersonalization Pattern: This pattern helps detect usage patterns during the testing process; This gives a clear view of what users prefer and reject during the use experience.
○ Predictive Analytics and Identifying Patterns and Anomalies: This pattern helps to analyze all available information about the experience of using prototypes of promising ideas, recommends the best idea among them, and predicts their success rate.
○ The Recognition Pattern: It helps to perceive the usage pattern during the testing process; This indicates whether the models and hence the ideas need to be developed or not.

7- Evaluate:

- Phase details: During this phase, the product is commercially evaluated, its proposed price evaluated, and it is ensured that it achieves the primary objective of the ongoing design process.
- The role of artificial intelligence: Using a group of artificial intelligence patterns combined together, this stage can be completed with less effort and time, and these patterns are:

○ Personalization The Hyperpersonalization Pattern: This pattern determines the impression users make of the product.
○ The Conversational Pattern: This pattern helps to build a chat program to interact with consumers and users and to know their opinions about the product with all its specifications, including its suggested price.
○ Predictive Analytics and Identifying Patterns and Anomalies: This pattern helps in analyzing consumer and user opinions, suggesting the most appropriate price for the product, forecasting sales, and also predicting the success rate of the product in the market.

○ Autonomous systems pattern: This pattern helps to change the language of communication with the product and its attachments from catalogs and others, depending on the country to which it is directed or designed.

Recommendations:

The research recommends:

1- The need to make use of artificial intelligence techniques in practicing the industrial design process.

2- The necessity of building an integrated strategy to take advantage of artificial intelligence techniques in practicing the industrial design process, through multiple studies that complement each other, addressing all the details involved.

3- The necessity of following up and developing the industrial design process cognitively and skillfully to keep pace with the continuous developments in the various concerned disciplines, and to benefit from them as well.

4- The necessity to popularize the culture of using artificial intelligence as an aid in the industrial design process among students and practitioners of the specialty.

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