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The Impact of Artificial Intelligence on Design Engineering

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ABSTRACT

The purpose of this research paper is to evaluate the role of artificial intelligence in the field of design engineering by discussing the contribution of artificial intelligence to the field of design engineering. This research paper further examines whether using artificial intelligence can be advantageous or disadvantageous to design engineers and to relevant stakeholders, by critiquing it through secondary sources. This research paper analyzes the growth of artificial intelligence in various aspects related to design engineering and explains the reasons behind the same, using primary sources.

Keywords: *Design Engineering, Artificial Intelligence*

I. INTRODUCTION

What is artificial intelligence?

Artificial intelligence, also known as AI, is arguably the most discussed topic in the world in the 21st century. The definition of artificial intelligence differs from being a branch of computer science, to the type of technology that can make machines and computers smarter. However, artificial intelligence can be explained simpler by realizing that artificial intelligence is the science or innovation of making machines do some things humans can do. The concept and application of artificial intelligence has been very beneficial for humans ever since the 21st century, but has still sparked a global debate on the types of threats it can pose to humans. Artificial intelligence has already been exploited in many companies, industries and professional fields worldwide.

What is design engineering?

There is another educational and occupational field which can really benefit from the development of artificial intelligence, one which is very important in almost every sector of the world. The development of artificial intelligence had a really fascinating impact on the field design engineering, and design engineers. Design engineering is the study of changing complex models or designs of a product to improve efficiency and management of resources. To be successful, a design engineer must remember the function of the product and make it safer to use. There is not a universally accepted definition of design engineering but it utilizes problem-solving skills, and produces artifacts. These artifacts can be completely unknown to the world or a modification of a product that exists. In the 21st century, the invention of artificial intelligence revolutionized design engineering while also damaging it to some extent.

Why is this a relevant topic?

It's important to discuss the strengths and limitations of artificial intelligence in design engineering because in the future, it's likely that artificial intelligence will contribute to most work people do and design engineering is crucial for electronics, aeronautics, engineering, and other professional areas that will also improvise in the future. It's essential to know how two

extremely important parts of engineering and science will compliment each other in the future, while boosting their popularity within common people.

How do artificial intelligence and design engineering 'compliment' each other?

In the current decade, design engineering provides engineers and designs with a competitive product (high quality) and market value for their product. The effectiveness of these projects can be boosted by using online applications, design tools, websites, videos and textual information generated by artificial intelligence. Many softwares have been developed specifically to aid designers and allow their work to popularize. Virtual reality and online simulations are another way of exploring creative ideas design engineers have. However, it's debatable that artificial intelligence is not completely helpful for design engineering.

II. LITERATURE REVIEW

How can artificial intelligence provide opportunities, or is it a threat?

Artificial intelligence is gaining popularity rapidly around the globe. Many people have started using it, even high school students. Artificial intelligence is supporting people by improving their professional lives, their physical or mental health, entertainment and connecting with more people. In the past few years, artificial intelligence has improved performance and capabilities of several products, ideas, artifacts and data generated by humans. It can provide immense opportunity for advancement and development in the technological field, but can also pose a threat to our society. Artificial intelligence has been used to improve fields like social media, robotics, e-commerce, and security. By using artificial intelligence in these areas of society, people have been able to study artificial intelligence and reflect whether it can be harmful. There are many disadvantages to using artificial intelligence as well. What are the disadvantages of using artificial intelligence?

Artificial intelligence machines or computers are expensive:

The tools or components required to build artificial intelligence are expensive and artificial intelligence doesn't become cost efficient. It will take a lot of money and time to repair and rebuild the artificial intelligence machine if it is damaged. The prime reason for the high cost of building artificial intelligence is the expensive construction of hardware required to run the algorithm in the machines. Specialized hardware is required for artificial intelligence machines as it increases the ability to store high amounts of data and increase functionality of the computing for the machines. As artificial intelligence develops, the cost of hardware will keep decreasing (it is non-static), making it easier and cheaper for businesses or companies to use it. When data is collected by AI, it has to be cleaned, processed and organized before analysis where a software is used. The softwares can be expensive too, and they add to the 'software costs'. They force businesses and companies to plan these costs in the original budget planning of using artificial intelligence. In addition, artificial intelligence requires labor and training which doesn't make it cost efficient.

Artificial intelligence can cause unemployment:

Based on particular industries, artificial intelligence can increase or decrease jobs for humans. After the development of artificial intelligence, humans become lazy and require artificial intelligence to do their work. Many businesses and professional leaders are replacing their employees with machines because the quality of work completed using artificial intelligence is better and they will not have to pay their employees wages anymore. Many companies around the world have decided to use artificial intelligence to collect data and analyze data to help their business or technology model succeed. They prefer using artificial intelligence to work, because it is great at analyzing data and leaves less room for error as compared to an employee because the artificial intelligence tool has been created by professionals who store accurate data in the AI machine. AI can easily replace humans in these fields, which will cause many people to lose their jobs even if they really need it to support themselves. However, there are ways through which artificial intelligence can be used in our favor because it also has many advantages.

What are the advantages of using artificial intelligence?

Artificial intelligence has many capabilities

Artificial intelligence is potentially growing faster because of how it specializes in multitasking because of improved algorithms, advanced computing, and data storage power. By adding these capabilities, artificial intelligence can be anthropomorphised to perform tasks which humans can, at a certain level of intelligence we can program. Artificial intelligence can do almost everything humans can with a higher level of productivity and accuracy. Artificial intelligence is used for profiling, which involves machine learning that can segregate and organize processed data. In recent years, artificial intelligence has helped make accurate predictions about stocks, weather, politics and many people working in these areas are satisfied with it. A great feature of artificial intelligence is that it can understand languages and allow humans to communicate with it, by using voice messages, texts, chatbots and images. This feature is also known as 'Natural Language Processing (NLP)'. Artificial intelligence paves way for goal achievement and can even perform complex tasks like object recognition and pattern identification. Another major advantage of artificial intelligence is its accessibility.

Artificial intelligence is accessible and available:

Firstly, artificial intelligence is available anytime. Anyone can use artificial intelligence tools online. Some of those apps or websites require user payment, but most of them don't. A common reason people use artificial intelligence over humans for working is because artificial intelligence won't stop working after a particular period of time. Humans don't work for a high duration of time because they need breaks and need to focus on their personal life as well. These are things that artificial intelligence doesn't have to focus on and has to complete the task in hand, making it available for use more often. People can

download AI applications on their smartphones, laptops and other gadgets that allow them to explore the benefits of artificial intelligence. Social media is a great example of how people are communicating with more people frequently, using the artificial intelligence technology built in social media applications. People can use it from the comfort of their home, as per their convenience. These artificial intelligence applications or websites are also accessible anytime and anywhere (with the internet), which is the best thing about them.

Is artificial intelligence hopeful or harmful? (Summary)

The discussion and evaluation of the information given above suggests that artificial intelligence can be very beneficial for future society. People can use artificial intelligence to complete daily tasks and make their lives simpler. However, with artificial intelligence evolving extremely fast, anybody can misuse it to hurt the internet and convert it into a threat. As developers of artificial intelligence, humans need to protect it and learn how to use it to a particular extent only, while keeping in mind how harmful it can be. Artificial intelligence is provoking mixed feelings in the field of design engineering as well, which is extremely crucial to understand.

III. METHODOLOGY (MATERIALS AND METHODS)

To what extent, has AI succeeded in improving innovation in past years?

There are many forms of technology where artificial intelligence has been implemented to improve functionality, reduce effort and motivate development in many different fields.

The following survey was conducted to support the information above, as people have become addicted to AI and use it to perform most tasks in their daily lifestyle. The following survey allows responders to reflect on how frequently AI is used in their daily lives and if many of those responders realize their dependence on AI or not:

Please Note: The responders of this survey have given consent for sharing and evaluating their responses for this research paper. The survey consisted of simple questions and only a few volunteers elaborated upon their responses. The author of the survey deleted a few invalid responses that were not related to the topic.

Survey - AI & Design Engineering

Please Note: By filling the form, you are giving the author consent to use your responses as a survey to display and analyze relevant data collected through this form. Thank you for giving consent! (Your details will be kept anonymous).

Survey Strength: 39 valid responses, consisting of- students, teachers, employers and employees.

<p>If you enter a mall, you see that doors open automatically sometimes. Do you think this is AI used in design? *</p> <p>Your answer</p>	<p>Do you think that AI is misused by criminals to steal and manipulate data online? *</p> <p>Your answer</p>
<p>When you scroll through social media, similar products and content loads up on your feed after a while. Do you think AI is accepting your browsing history? *</p> <p>Your answer</p>	<p>Do you think AI has been advantageous to study economics and help people predict the success of their investment in stocks or crypto? *</p> <p>Your answer</p>
<p>When you use Siri, Alexa or Google Home; does it give you the impression that AI is able to understand your language and can successfully communicate with you? *</p> <p>Your answer</p>	<p>The field of medical science uses AI frequently now. Do you think it is beneficial for patients in hospitals? *</p> <p>Your answer</p>

Response: The following responses are based on how often people use AI to improve their lifestyle and how various technologies have different capabilities that transform their daily life if they use it.

The primary stakeholder group involved in the survey were a bunch of students who use AI for basic things such as completing school assignments, conducting research, communicating with each other and entertaining themselves. By surveying the group of students, it can be observed that similar impacts of AI are relevant for students using it around the world.

Sample Student Response:

If you enter a mall, you see that doors open automatically sometimes. Do you think this is AI used in design? *

Possibly? With the limited programming knowledge I had I'm guessing you can use Arduinos and Raspberry Pis, but that doesn't make it AI.

When you scroll through social media, similar products and content loads up on your feed after a while. Do you think AI is accepting your browsing history? *

If cookies are AI, then yes. I have noticed advertisements similar to pages that I have interacted with.

When you use Siri, Alexa or Google Home; does it give you the impression that AI is able to understand your language and can successfully communicate with you? *

No. It feels like these AI user tools or bots (I'm not sure what they're called) are programmed in a manner where they can only understand specific questions or orders from people, and lack the nuance required to understand certain vocabulary, accents maybe, and sentences.

Do you think that AI is misused by criminals to steal and manipulate data online? *

Possibly. I don't know if cookies are AI, but if they are then user data that should be private is being encroached upon.

Do you think AI has been advantageous to study economics and help people predict the success of their investment in stocks or crypto? *

I'm not aware of this topic, I cannot make any statements.

The field of medical science uses AI frequently now. Do you think it is beneficial for patients in hospitals? *

Possibly. It could help Doctors and nurses to cope with menial tasks and recognising changes in the body which can be missed by humans at first glance.

Positive Impact of AI on Students' Lifestyle

In the 21st century, AI has helped students while researching information for school projects and provides various opportunities to enhance their research and presentation skills. The lockdown imposed by the government in many countries forced the closure of school during the COVID-19 pandemic, but students could still attend online classes and learn virtually. The AI field has come a long way in terms of what they offer to students, and they can enhance such capabilities even further.

The technology of personalized learning involves AI-assistance to educate in personalized lesson plans and assessments that vary with respect to each student's strengths and limitations, as it can analyze data on each student's performance quickly. The students' experiences will be positive and their motivation may increase as a result, which will eventually improve their academic performance.

ChatGPT, an AI tool, has the potential to completely transform academic research since it can process and analyze massive volumes of data more quickly than how students are used to doing so. By doing so, it can lead to new discoveries, ideas, and literature reviews. ChatGPT can help students by generating text and offering comments and insights. It can potentially be applied to language processing tasks, including sentiment analysis, text summarization, and language translation in order to analyze mixed data.

ChatGPT and other AI tools can only provide suggestions and human intellect is vital and students will retain ultimate decision-making power and accountability for the outcomes they achieve in academic work.

Negative Impact of AI on Students' Lifestyle

As AI tools developed, they were misused by students as well, raising ethical concerns by teachers and parents. The use of ChatGPT is common for students as they plagiarize. The responses gathered by ChatGPT to answer the students' prompts are sourced from multiple sources across the internet, and detection tools find it difficult to trace data copied by students from AI tools.

The AI field also endangers students' privacy and data security. AI tools collect personal data to customize a user's experience and help prepare AI models they will use. The chance of AI stealing a person's data increases if the AI tool is free of cost (to operate).

The ability of the human brain to inquire will be limited when using AI when there will be an increase in the accessibility of AI tools. As a result, students' ability to explore new things is gradually diminished as they will have a lesser thinking capacity. Furthermore, a student's constant engagement with technology will force them to think blindly.

The sheer amount of reliance students have in almost every aspect of life on AI technology is a problem as well. Unquestionably, AI technology has raised living conditions and made life simpler, but it has also had a terrible effect on humankind, making many students sluggish and impatient. The human brain will progressively get starved of mental effort as it dives deeper into each task, such as organizing and planning for things- something students often do to succeed.

It is sensible to claim: the sample student response (from the survey) provides lesser insights to examine the impact of AI on people. However, some of the responses highlight how AI has evolved and people see it working everywhere, known or unknown to them whether the machines they use actually function using AI technology. In the field of design engineering, a similar scenario can be observed. The modern-day design engineers are skilled professionals, but most of them are unaware of the potential opportunities and threats of using AI technology to enhance the design engineering field. In 2023, the most common AI tool being used is ChatGPT and it has different impacts on the field of design engineering.

Impact of ChatGPT on field of Design Engineering

The existence of ChatGPT is the reason people believe that AI is capable of helping them research and design. The tool is best described as a large language model trained by OpenAI that is capable of understanding and generating text and answering a wide range of questions as well as generating creative writing and text summaries.

ChatGPT and Mechanical Engineering:

Firstly, mechanical engineers are required to find vast amounts of data efficiently, in a short period of time. ChatGPT can answer many questions about mechanical design, selections of materials, manufacturing process and more things that design engineers struggle to find information about. ChatGPT can provide multiple results, matching a person's search or query and allows them to find information quickly.

Example

 **You**

As a design engineer, I have to create a "sand filter and separator" machine with

Dimensions: 50 × 30 × 45 Centimeters

 **ChatGPT**

Creating a sand filter and separator machine involves several components and considerations. Below is a simplified conceptual design for a basic sand filter and separator machine with the given dimensions (50 × 30 × 45 centimeters). Please note that this is a conceptual design, and you may need to refine and customize it based on specific requirements, materials, and operational considerations.

Design Overview:

1. Frame:

- Construct a sturdy frame using materials such as stainless steel or aluminum.
- Ensure the frame dimensions are 50 × 30 × 45 centimeters, providing a robust structure for the entire machine.

2. Sand Filter Chamber:

- The sand filter chamber is where the separation of sand and other particles from water occurs.
- Construct a rectangular chamber within the frame, with the appropriate dimensions.
- Use a durable material for the chamber, such as corrosion-resistant plastic or metal.
- Include an inlet for water entry and an outlet for filtered water.

3. Filter Media:

- Fill the sand filter chamber with a suitable filter media. Common choices include graded sand or gravel.
- Ensure the filter media is easily replaceable for maintenance purposes.

Secondly, many people might ignore certain factors during the development of their product and ChatGPT ensures that the user considers every minor detail to successfully build the product. ChatGPT provides safety considerations and notes to ensure that the user doesn't miss out on valuable information that is essential for their success. By doing so, ChatGPT reminds its users to prioritize health concerns. The tool is beneficial for design engineers as many projects require potentially harmful resources that need to be handled carefully, as advised by ChatGPT.

Example

9. Accessibility for Maintenance:

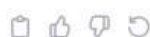
- Design the machine with accessibility in mind, allowing easy maintenance and replacement of components.

10. Safety Considerations:

- Ensure the design complies with safety standards.
- Consider adding safety features such as emergency shut-off mechanisms.

Note:

- This conceptual design provides a basic outline, and you should consult with relevant experts and engineers to finalize the detailed design based on specific project requirements, environmental considerations, and local regulations. Additionally, consider consulting with a professional mechanical or civil engineer to ensure the structural integrity of the design.



ChatGPT can also provide great insights and suggestions to improve the quality of the designs generated by engineers. If design engineers use ChatGPT, they can present ready-made designs they created and get constructive feedback to improve the quality of their designs. The feature aids the sustainable, and safe development of quality products.

Example



You

can you provide suggestions and insights to make my product more sustainable?



ChatGPT

Certainly! Making your sand filter and separator machine more sustainable involves considering various aspects of the product's life cycle, from material selection to energy efficiency and end-of-life considerations. Here are some suggestions and insights to enhance the sustainability of your product:

1. Material Selection:

- Choose materials with a low environmental impact, such as recycled or recyclable plastics, metals, or composites.
- Consider using bio-based materials or those with a lower carbon footprint.

The user can vary the intensity of their response to gain a better understanding of the expectations set by the AI tool.



You

Please explain the first point in greater detail



ChatGPT

Certainly! The first point regarding material selection is a critical aspect of making your sand filter and separator machine more sustainable. Sustainable material choices can significantly impact the environmental footprint of your product. Here are some detailed considerations:

1. Recycled Materials:

- **Explanation:** Choose materials that have been recycled or reclaimed from post-consumer or post-industrial sources.
- **Benefits:** Using recycled materials reduces the demand for virgin resources, lowers energy consumption in the production process, and minimizes waste in landfills.

2. Recyclability:

- **Explanation:** Select materials that are recyclable at the end of the product's life cycle.
- **Benefits:** Recyclable materials can be reprocessed into new products, reducing the overall environmental impact and promoting a circular economy.

3. Bio-based Materials:

- **Explanation:** Explore materials derived from renewable resources, such as bio-based plastics or composites.
- **Benefits:** Bio-based materials often have a lower carbon footprint compared to traditional petrochemical-based materials, contributing to overall sustainability.

Lastly, ChatGPT and AI coding softwares can help a design engineer program their robot or machine to perform tasks effectively. ChatGPT's feature to share program code for multiple programming languages allows many users to develop and test the code to enhance their app/game development skills. It allows students and programmers to experiment with different programming languages and helps them to create apps/games faster. The AI tool also gives examples of the response for the user to choose from, and enhances its own potential to provide greater insight.

Example

A You

generate the code for a menu bar option for a webpage created using HTML and styled using CSS. match the theme of "health lifestyle"

ChatGPT 3.5 ▾

Which response do you prefer?

Your choice will help make ChatGPT better.



Response 1

Certainly! Here's an example of a menu bar option for a webpage related to a health lifestyle using HTML and styled with CSS:

```
html
[ ] Copy code

<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1">
  <title>Health Lifestyle</title>
  <style>
    body {
      font-family: 'Arial', sans-serif;
      background-color: #f8d7da;
      margin: 0;
      padding: 0;
    }

    header {
      background-color: #4CAF50;
      color: #fff;
      padding: 15px;
      text-align: center;
    }

    nav {
      background-color: #333;
      overflow: hidden;
    }

    nav a {
      float: left;
      display: block;
      color: white;
      text-align: center;
      padding: 14px 16px;
      text-decoration: none;
    }

    nav a:hover {
      background-color: #ddd;
      color: #333;
    }
  </style>
</head>
<body>
```



Response 2

Certainly! Below is an example of a simple menu bar option for a webpage with a "health lifestyle" theme, created using HTML and styled using CSS:

```
<header>
  <h1>Health Lifestyle</h1>
</header>

<nav>
  <a href="#">Home</a>
  <a href="#">Articles</a>
  <a href="#">Recipes</a>
  <a href="#">Fitness</a>
  <a href="#">Contact</a>
</nav>

<!-- The rest of your webpage content goes here -->

</body>
</html>
```


In this example:

- The ``header`` contains the main title of the webpage.
- The ``nav`` element is used for the menu bar with links to different sections of the website.
- The styling is done using CSS, with a green color theme for the header to convey a sense of health, and a dark color for the navigation bar for contrast.

Is artificial Intelligence killing creative thinking skills?















The online tool 'Builder.ai' is accessible to people who open the website on a browser. It allows designers to create layouts and builds applications according to their specifications very easily using a simple process. The results of this question will be obtained by personally navigating through the website and creating a demo application using the online software.

The developer will follow the following steps:



The user can select to watch a free demo, making it easier for a developer to navigate throughout the course of the process, so they can utilize the tool to the best of its ability.

If the user skips this step, they can choose to connect to 'the right Builder.ai partner'. The screen will load to a new page where the user is expected to answer certain questions related to the theme of the application they are developing.





What is the category of your app idea?

 Utilities	 Travel	 Social	 Shopping
 Productivity	 Photo & Video	 News	 Entertainment & Music
 Navigation	 Business & Finance	 Food & Drink	 Health & Fitness
 Lifestyle	 Medical		

What best describes your idea?

 The main goal of my app is selling products	 The main goal of my app is something else, not just selling products
--	---

How are you funding your app?

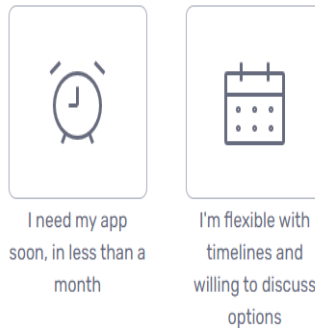
 I don't currently have a budget	 I am using budget from savings	 I am using budget from investors	 Other
--	---	---	--

What is your rough budget?

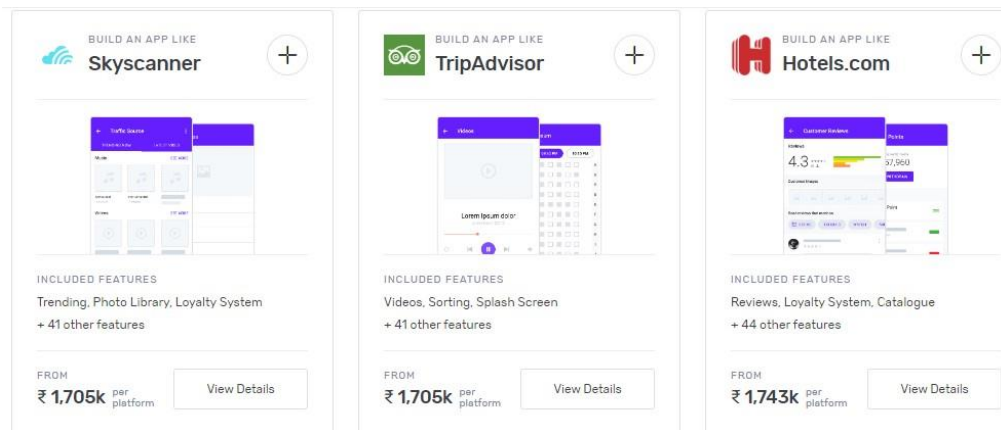
\$0-1K	\$2K-5K	\$6K-10K	>\$10K
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☐ I'm unsure/flexible

How soon do you need your app?



Based on the results, the AI tool will recommend the developer on which type of platform they should use. The new interface connects with the developer and interprets the exact purpose of the application they want to build.



The user can sign-up and access extra features to complete the app development.
Discussion (Results and Evaluation)

What is creativity?

If an individual thinks about something for the first time, they have a creative mindset about that particular thing; even if others have individually thought about it before.

Example: The design engineer wants to build a robotic arm and realizes that he/she can vary the size of the machine.

The importance of creative thinking can be exaggerated to some extent by many, but it has led to many discoveries and inventions to benefit humanity, everywhere in the world. These types of thoughts demonstrate that the individual which possesses them has historical creativity.

Example: The discovery of Buoyancy was discovered with Archimedes's 'eureka moment' in the bathtub.

As we view someone's legacy as significant and long-lasting, the greater their creativity influences other people's perspectives and it doesn't matter how far they are from the person which explored the idea.

Why can't artificial intelligence succeed in improving creativity?

The primary distinction between AI-driven creativity (generative tools) and human creativity is- AI-driven creativity isn't the result of a mind-body conflict throughout development. Humans' thought process is shaped by their growth from a young age and positive or negative experiences they have faced in life. In contrast, artificial intelligence is developed without any of those experiences similar to a human, and simply follows the program created by humans. The artificial intelligence models are heavily reliant on the intricate statistical modeling of digital data. Hence, if AI becomes more widely used, our cognitive variety may

decline and societal cohesiveness may rise as a result of our overuse of artificial intelligence. The process will destroy innovation among the populace.

The possibility of artificial intelligence-produced films, TV shows, books, and artwork are not the only threats. The development of artificial intelligence will possibly influence our shared public areas, our cars and our houses in the future. By the increased influence of identical settings and experiences, we could observe a homogenization (a lot of similarity) of thought.

How can artificial intelligence and creativity co-exist?

The technology of generative artificial intelligence will be very revolutionary. The influence of generative artificial intelligence will become harder to stop because it causes change, uncertainty, and alienation in society as a whole, if people start choosing it over creative thinking. Humans have the best chance of continuing the mindset to be creatively active if they defend and value the human brain over artificial intelligence.

The first step towards fighting AI's ability to replace creative thinking, is to avoid providing it a legal personality, such as providing it the ability to train itself on protected content through "fair use" or granting copyright protection to AI outputs. By doing so, humans will undermine the creative system and run the danger of creating a generic spiral in human innovation.

IV. CONCLUSION

The research paper examines the role of artificial intelligence for relevant stakeholders as well as design engineers of the future decade, while highlighting the potential advantages and disadvantages of artificial intelligence by exploring tools (ChatGPT and Builder.ai) to understand the assistance they provide to future designers and developers.

The research paper consists of a survey of a group of students and adults which explores the impact of artificial intelligence on different people in different places. The first limitation of the research is that a few responses were collected to make assumptions. Secondly, a lot of artificial intelligence tools at the author's disposal could have been used to make even detailed findings to achieve the purpose of the research.

Conclusion Statement

In conclusion, the field of artificial intelligence is set to evolve in the near future and with a lot of new tools at disposal, design engineers should utilize them to segregate information and generate information quickly to aid the process of developing innovative products but should be wary of the threats artificial intelligence can pose to humanity overall, and use effective strategies to combat them.

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