



Using Virtual Reality to Help Solve Problems in Electrical Engineering Systems

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Abstract:

Virtual reality technology is one of the most famous techniques of the current era, which allows trying things that may be difficult to experience in the real world or that may be entirely fictional. It uses virtual reality technology in many applications, including sports and sports training, tourism and recognition of countries and regions, medicine and surgeries, architecture and construction, entertainment and games, education and general culture and digital art.

As this study came mainly to identify the possibility of using virtual reality techniques to solve problems in electrical engineering, as the descriptive approach was relied upon by collecting information related to the study from publications, books, articles, websites and special studies in this field in addition to similar study cases related to the use of the system, this information is useful in knowing the characteristics of virtual reality, its tools, uses and capabilities, in addition to collecting information about The most prominent electrical problems and how to deal with these problems in order to reach solutions

After collecting data, it was concluded that virtual reality has a high ability to confront and address electrical engineering problems, as virtual reality works to enhance work efficiency and increase accuracy, and also helps in implementing proposed solutions and projects more quickly and efficiently.



Keywords: Virtual Reality, Electrical Engineering Systems, Problems in Electrical Engineering Systems, Application of Virtual Reality.

Introduction:

In light of the communication revolution that the world is experiencing today, in the era of the revolution of knowledge and communications technology in which the world has become one village, where the world is witnessing a huge knowledge explosion, whether in the diversity of knowledge or its quantity, until this era was called the era of knowledge explosion. There is no doubt that human societies in general are experiencing an unprecedented knowledge and technology revolution, as the Internet is one of the most prominent of these innovations that imposed itself at the global level, during the past few years, until it became a method for daily interaction, and the rapid spread of this network made it one of the milestones The modern era that some even called the era of the Internet or the era of the information revolution. Many researchers have confirmed the strong impact of scientific research on production and development, and technical progress, as there are many efforts they made to achieve progress and achievement in all fields, while ensuring success for economic planning, and the disclosure of the means and tools for production and progress (Eltodary, 2009).

What applies to the scientific and engineering disciplines applies to the electrical engineering affected it is still affected by not a few of these developments and developments, despite the diversity of these. The effects and their complexity, but the revolution taking place in the advancement of computers and communications is considered the most important of these influences (Al-Musawi, 2009).

Technological development included the great position in the world, especially after the invention of the computer, and the emergence of the Internet, as it became necessary for everyone who follows the path of learning to deal with digital information systems and technological development. Not only that, but digital devices have begun to specialize in serving different fields, each one separately, and there are certain programs that use the devices to serve different specialties.



It is noticeable that the development of applications for electrical engineering Donna is lagging behind most applications of other scientific and engineering disciplines due to the mistaken belief that those applications conflict with the possibility of developing, creating and preventing it from being practiced properly.

One of the most prominent developments is the use of virtual reality to help advance the electrical engineering.

Far from being the technology of the future, virtual reality is now embedded in many industries and sectors, from entertainment, communications and education to design, scientific research and defense. Professor Anthony Steed, of the University of London's Virtual Environments and Computer Graphics group, is revealing how three companies are using immersive technologies to transform their engineering operations. The UK has a long history of working in virtual reality (VR). In the 1990s, leading British companies such as Virtuality and Division introduced immersive systems ready for a wide range of industries. While this hype and those companies have faded, over the past twenty years, other areas of use of these systems have emerged. Professor Frederick B. described Brooks Junior in his 1999 article "What is Reality About Virtual Reality?", Published in IEEE Computer Graphics & Applications, some examples of "traditional" engineering uses of virtual reality: design review and vehicle training. In that era, when sophisticated virtual reality systems cost hundreds of thousands of pounds, investment can be justified only in situations where training is very dangerous, or there is a clear and understandable saving in the costs of the design process. Since the late 1990s, desktop computers have been able to process and manipulate the most complex 3D models. Over the past two years, a turning point has been passed as sophisticated desktop computers are now able to drive real-time graphics at the speed required to enable a low latency experience in immersive systems. The virtual scene can be designed on both the appearance and behavior of real scenes indicating clear ways to exploit engineering. While simulation and visualization has long been a tool that engineers have used, virtual reality promises to make these technologies accessible (Al-Naje.E, et al, 2019).



After that, virtual reality became part of the work of individuals, in addition to playing a major role in various fields. Since design, interaction and user evaluation are very important, and it is important and the role of virtual reality, this study came with the aim of using virtual reality to help solve problems in electrical engineering systems.

Research problem:

There are many crises that the world has faced daily for years, without radical solutions that provide some of its rights. Electricity remains a crisis of crises that have not yet found their way towards a solution, pending solutions to get rid of these problems.

One of the most famous electrical problems is the occurrence of a “lock” due to an excessive load on the cutter or connection by wires that are not suitable for pregnancy, which leads to contact with each other. For prevention, accurate calculations must be made to determine the cutter and the wires used. Adequate experience and holding live non-insulated wires or as a result of touching or holding some unsecured household appliances is good. To prevent good work, some household appliances are burnt due to an overload of the network. This is due to the inexperience of some people and placing wires with a large section inside the protection fuses so that they do not burn and therefore the cutter does not feel the presence of excessive effort and the increase in the device passes and is destroyed. For protection, the burning fuse must be replaced by another of the same quality and the same thickness of the wire felt.

This study uses virtual reality on projects related to electrical engineering, by studying virtual reality as a tool for the process of studying, designing, developing, and presenting projects such as those related to the development of electrical engineering and solving problems that face.



Research significant:

Electrical engineering is a comprehensive discipline for science, mathematics, and research to develop, create, improve, and repair electrical circuits, all types of small and large appliances, tools, and electronic equipment, and with the continuous development of electrical engineering things have become easier for people, by inventing a diverse group From electrical devices in various fields, and also includes designing electronic systems that deal with interdisciplinary design issues from complex electrical and mechanical systems, in which electrical engineers use various tools such as the final analysis device to a measuring device Simple voltmeter to design programs and sophisticated manufacturing, which is being utilized from the computers to achieve this with high efficiency.

When we contemplate our world today, we find that there are social, political and technological transformations, from where certainly; communications technology has had an impact on the world in various degrees in economic terms social, political and cultural have also affected media discourse and media technology. Power the driving force behind this technological development is the information revolution and the digital revolution, and this technology are still reshaping the global system in a new way according to policies that make it more converging. And that daily life is shaped so that it places space and time, and that electricity is the field of our daily life there is a need to use technology in electrical engineering, which is about to transform into spaces emerging plastic arts. The digital revolution will also affect, negatively or positively, or both (Dakhel.A, and Naguib.A, 2002).

Study questions:

This study aims to answer the following main question:

How can virtual reality be used to help solve problems in electrical engineering systems?

Through the following main question, several questions are branched which are:

1. What are the most prominent electrical problems?
2. What is the concept of virtual reality technology?
3. What are virtual reality applications?



4. What are the applications of virtual reality in the field of electrical engineering?

Objectives of the study:

This study aims to answer the following main question:

Identify how to use virtual reality to help solve problems in electrical engineering systems.

Through the following main question, several questions are branched which are:

1. Identify the most prominent electrical problems.
2. Identify the concept of virtual reality technology.
3. Identify the virtual reality applications.
4. Identify the applications of virtual reality in the field of electrical engineering.

Hypotheses:

There are two main hypotheses for this study:

- 1- The use of the virtual reality system would bring about a positive and fundamental change in many applications and in various fields.
- 2- The use of the virtual reality system would bring about a positive and fundamental change in the process of solving the various electrical engineering problems, and it is possible to design and develop the proposed projects with the participation of the largest number of specialists from different non-engineering disciplines, such as specialists in computer science, investors, the public and users.

Mechanism of Research:

The study studies the virtual reality and identifies it and the most prominent applications that have been used by virtual reality, by identifying previous studies that relate to the study and then analyzing it, to benefit from it in solving problems that face electrical engineering.



Research methodology:

The process of gathering information and the method used in this study was through relying on the descriptive method, through searching in libraries and collecting information related to the study from publications, books, articles, websites and special studies in this field in addition to similar study cases regarding the use of the system, this information is useful in Knowing the characteristics of virtual reality, its tools, uses, and capabilities, as well as gathering information on the most prominent electricity problems and how to deal with these problems in order to reach solutions.

Literature reviews:

Problems in electrical engineering systems

Electricity networks worldwide are undergoing transformations involving upgrades of their distribution, transmission and generation systems, which are mainly in the form of monitoring and communication technologies that provide more accurate information about the state of the system at any point in time. Electricity consumers do not need a predictable, stable level of electricity. Electricity demand drivers include weather conditions, energy efficiency regulations and macroeconomic conditions, personal preferences. The scorching temperatures during the summer and the extremely low temperatures in the winter increase the demand for electricity, which leads to daily and seasonal changes in demand. The services that are only used intermittently throughout the day (such as lighting) cause changes in demand from hour to hour and even from second to second, although the daily patterns are somewhat stable. (Electric Power Research Institute, 2014)

The risk of electricity demand is a major problem, as consumer demand is variable and unpredictable, and utilities face the risk of demand. The risk of demand can be defined as the doubt about whether contracted electricity is sufficient to meet the demands of electrical load. The supply in the system is determined by a distribution system through which power stations are turned on and off, with cost (marginal) power stations distributed. In addition, some backup power sources are “rotated” in order to achieve least overall or rapid response to increases in demand.



The end result will be to place broadly different wholesale prices on the perpetrators of these problems, in particular, in the presence of poor selection and ethical risks. The first case occurs because of the variation in information between the companies. The organizer with regard to the true level of costs, the second case occurs due to the positive correlation between the company's profitability and the administrative effort, which weakens the incentive to reduce costs, due to the unpredictable variable demand, and the inability to store electricity efficiently on the scales of wide, in addition to distributing different sources of energy generated to meet the different levels of demand. In the event that supply and demand are not able to match, the system may become ineffective (Joskow, Paul L., 1997).

The differences in wholesale and retail prices are constant and do not change with time. For retail, the majority of consumers in the small residential and commercial sectors face prices across the system. (Per kilowatt hour) kilowatt hour, that is, the prices do not change according to real time, for system-wide demand, as a result, retail prices do not reflect the marginal (marginal) cost of generating and distributing electricity, but rather reflect average costs in light of past capital investments and signed contracts, and the mismatch between dynamically changing wholesale prices and selling prices Fragmentation that does not change depending on time to inefficiency, and when electricity consumers encounter retail prices that do not reflect the marginal costs of generating electricity, they will fail to save when marginal costs are higher than retail prices. (Joskow and Wolfram, 2012)

Integration of renewable, the renewable resources used to generate electricity include wind, geothermal, solar energy, biomass, some types of hydroelectric power, and some other secondary sources. Considering that the main aspect of generating electricity from renewable resources in relation to the electricity grid is the intermittent nature of the high-voltage electricity supply system, renewable resources for electricity generation are called "intermittent renewable energy sources" (IRESs), unlike traditional fossil fuels or nuclear energy sources, intermittent renewable energy sources do not create a continuous flow of current across the network; rather, they produce electricity only in certain environmental conditions (for example, when the wind is blowing or when the sun is shining) .



Contrast creates a problem given the inability to control the inflows entering the system, and the lack of control (by way of management) may cause problems related to the stability of the electricity supply in the network, which increases the possibility of failure to meet all the demand related to the electrical load in the system or worse interruptions within this system (Resnick Institute, 2012).

Virtual Reality:

In the early nineties, especially in 1989, the term virtual reality appeared, that virtual reality is a man-made technological world that is dealt with through a computer, so that a person can interact with him directly as he interacts with the real world, and the third count plays an important role in reality technology The default, where it allows to see the three-dimensional outputs as in concrete reality, by involving the visual, tactile and tactile senses to reach a near-reality experience.

Also, to is an embodiment (imaginative by advanced technological means) of the real reality, but it is not real, as it gives us infinite possibilities of light, extension, sound, sensation, vision, and disturbance of feelings as if we are in the physical reality. One of the most common definitions of virtual reality is a graphical simulation of physical (natural) reality through a very complex mock environment, with spatial dimensions, its applications are based on creating three-dimensional environments using computer graphics and simulators, created by the computer, and can be invested in roaming within the virtual environment, Where the user interacts with its vocabulary and its subtle details, as it does in its daily life when it interacts live with the vocabulary of real life, and it prepares for the individual the ability to sense it with different senses and interact with it and change its data, so the sense of integration cannot be felt in that environment (Mohammed .A, 2010).



Virtual reality technology is connected to a computer, and it is equipped with two small screens in front of the eyes, and when the person wearing the helmet moves his head, the image that appears on the screen changes very quickly, and another image appears in its place, and whenever the person moves his head left or right, the image changes, if it is the image represents the depth of the ocean, for example, because a person is born with a virtual reality, as if he is present in the depths of the ocean and so on (AL-Heraze.sh, 2013).

Virtual reality is defined as an imaginary vacuum that is often manifested through a specific medium (theater, image, film, virtual reality), as well as a description of a group of objects (or objects) found in a specific space, and the rules and relationships that govern these objects. Virtual reality is the content of a specific place, and it can only be found in imagination or it can be published in some way that would make others participate in its creativity in it.

For example, when a certain play is described, the description here is by means of a superposition that includes actors, music, Conversation and stage, and through this overlay we can see the virtual world of the play. This is called simulation of reality, meaning that all the mentioned elements work to simulate virtual reality to be communicated to the minds of viewers, and as is the case in the theater, this matter applies to the technology (system) of virtual reality, when we want to show the virtual world through a system that brings the viewer data And interactions in a way that shows physical and technological in-depth and largely interacting with the user, we use the virtual reality system (Sherman, and Craig, 2002).



Application of virtual reality:

Virtual reality seemed like a new world that helps develop creative sense, and one of its applications in this field is the field of animation, as it works to provide a virtual environment that motivates them to produce films and animation using this modern technology, which in turn saves the artist time and effort, and creates a world filled with imagination and creativity, where virtual reality occupies a clear and large space in modern intellectual directives, where virtual reality techniques helped to enter the art a new era indicating a new aesthetic curve based on aesthetics available through technical means and optical relationships formation based on the different programming language, and through virtual reality it became possible to enter long distances of capabilities and ways of formation and expression between images and shapes, and it also helps to support the correlation between animation and virtual reality technology. Through this study, they concluded that: (Eldaly. A, 2019)

- 1- Virtual reality technology is a unique and destructive technology inside cinema and animation that has the ability to conquer the minds and hearts of the forum or the interactive audience.
- 2- Virtual reality technology represents a terrible development in the world of cinema, the world of animation and video games.
- 3- The role that virtual reality technology plays in the art of animation in creating an interactive environment between the movie and the recipient, to enjoy watching differently.
- 4- Virtual reality technology plays a prominent role in the field of cinema, animation, and video games, which in turn helps to shape cultural and social awareness through the ideas and information that you present to form the emotional thought of the forum.

The virtual reality system is considered one of the closest computer systems to simulate reality as an interactive system in which the human being is an integral part of it unlike other systems in which the person is only receptive, the virtual environment shown for a project.



This study has studied the possibility of using the virtual reality system in a theoretical and practical way to develop the urban environment in Palestine, especially trying to find solutions to the problems suffered by the city of Nablus Omrania, as the study selects one of the problems that the city of Nablus suffers due to its topography and that is the mountainous stairs that are considered a single path. Many mountainous neighborhoods in the city or a secondary pass for most of them and suffer from their use by the residents of these neighborhoods as they are not suitable for human measures and health. To achieve these goals, the study searches for previous applications of the virtual reality system on urban projects in Palestine or the region, and studies the objectives of their application to them and the method of application and its results, and after proving that there is a positive difference in the absorption when using the system, the study in this case in turn tries to apply the system to the study case. Of finding solutions to the listing problem in the city of Nablus.

The study also searches for study cases of the problem of mobility through the stairs and mountainous areas in the world to try to find and study the best possible solution that can be applied in the city of Nablus, and after finding the solution it is actually applied in certain areas of the city using virtual reality to support the process of systems design and development and develop scenarios for the way it works. After coming up with a result in a virtual environment for a city in which the proposed solutions systems are applied, the study studies the extent of the effect of using the virtual reality system in applying the solutions to the opinion and decision makers in the city and its residents and the residents of other Palestinian cities.

After recording the differences in influence and persuasion and attract the positive opinion of the slide that displays the systems solutions to the presentation of traditional projects and then viewed using a virtual reality system based study, the study, the adoption of the virtual reality system in the development and display similar projects are considered the nucleus for the advancement of the urban environment in Palestine for the better (Al-Sharif, 2012).



The use of virtual reality in global experiences has proven successful in achieving the desired goals. Virtual reality applications are considered advanced technologies and methods in the computer world that were created to provide assistance to individuals and institutions, and enable them to coexist with the conditions and difficulties of environments that are difficult to deal with or to be present in either because of their seriousness or high cost, or the impossibility of being in them such as the space environment or facing chemical explosions or Biology, the research aims to build a virtual reality system in order to monitor and manage field operations of the armed forces with their subsidiary bodies. And his ability to interact immediately with events to manage field operations, in addition to learning about the importance of virtual reality and its features as a computer technology and how to invest its applications in the rehabilitation and training of members of the armed forces and security services to increase their combat capabilities in the face of terrorism. Where the study concluded that the investment of virtual reality technology for the field of preparing and preparing fighters and managing combat and casual operations can reduce the blood of heroic fighters, by raising the combat capabilities and gaining experiences for them to face all conditions and possibilities through prior training on them, in addition to enhancing leadership capabilities and providing The possibility of the operational commanders to be present in the battle while they are away spatially about (Hussain. K, 2016).

The virtual reality to help solve problems in electrical engineering systems

There appears to be sufficient evidence to suggest that virtual reality can enhance electrical safety and design in the built environment and also develop training methods used to educate electrical service engineers and electricians. Electricity was and still is associated with many of the risks associated with its use in different environments, which provide a variety of electrical services provided to the general public who must live and work in these environments, to get rid of these risks and find appropriate solutions to solve electricity problems, virtual reality is used, as virtual reality has an advantage that distinguishes it from other technologies, most notably that it is safe for both the user and the equipment. It also helps the user to identify several conditions that may happen repeatedly, and the recurrence of this problem may expose the person to great danger.



As this study came with the aim of providing a virtual reality model that works to increase the security and safety of electrical problems in environments, as the virtual reality model for electricity can be used as a strong and high-quality guide to electrical safety, in addition to some applications to enhance the solution of these problems. Through the study, the following results were achieved. (Barrett and Martin, 2012):

- 1- Virtual reality helps to identify and understand the conditions and situations that are constantly being repeated.
- 2- Virtual reality technology is characterized by solving the problems of electricity at the lowest cost in order to create models that solve these problems.
- 3- Virtual Reality technology is characterized by its high capacity to build awareness and high culture about electrical safety while ensuring that accidents are reduced.
- 4- Virtual reality technology is characterized by its high capacity by building rules and laws on electricity among people.

There are many strategies that train people in electrical engineering through the use of virtual reality technologies and application programs with an interactive interface, where the study concluded that the use of virtual reality technologies works to improve the quality and efficiency of higher education, in addition to improving the qualifications, competencies and skills of graduates, It also works to increase their competitiveness in the labor market.

Consequently, it has a distinctive and fundamental role in solving many of the problems facing electrical engineering, through the use of these technologies that provide an interactive interface that improves the level of people and strengthens their ability to confront and solve problems (Kamińska, D., et al 2017).



Discussion the Result:

In this section the questions will be answered directly, as follows:

What are the most prominent electrical problems?

1. Increasing the demand for electricity permanently and continuously, so that it is difficult to predict
2. Consistency in wholesale and retail prices and no change, subsequently Electricity consumers face retail prices that do not reflect the marginal costs of generating electricity, and thus will fail to save when marginal costs are higher than retail prices.
3. Integration of renewable energy sources, where intermittent renewable energy sources do not create a continuous flow of current through the network; rather, they produce electricity only in certain environmental conditions, by creating variance as a problem due to the inability to control the inflows entering the system, and the inability Control in creating problems related to the stability of the electricity supply in the network.

What is the concept of virtual reality technology?

Virtual reality is one of the most important design techniques today and the pain of virtual reality or reality virtualization means the almost realistic representation of things, objects, people, and the environments in which they are being added the idea of permanent interaction between the user of the computer, graphics and digital photos that he deals with. It also means using the computer for interactive modeling and simulation to enable a person to interact with other artificial or visual 3D products or products. By making the user use it and live with it and it in three dimensions and deal with it in real time, it is real things that are on the ground.

Virtual reality represents a sophisticated method for visualizing graphics 3D or fictitious figures and fictitious figures that are not present in reality, but the study conditions require real visualization of them in space or on two-dimensional flat screens or display walls, in order to take different decisions regarding them from visualization and planning for a long period before they exist In fact.



Thus, virtual reality is a method that allows us to go to either that we would not have been able to access one day and do dangerous or difficult or costly actions, as it is a way to make the computer adapt and adapt to the user instead of the other way around. Virtual reality uses are not limited to those mentioned but extend too many current or future uses.

What are virtual reality applications?

First; the use of virtual reality in the field of animation, it has become possible to enter and ways to form and express between images and shapes, as it helps to support the interconnection between animation and virtual reality technology. It plays an important role in the art of animation in creating an interactive environment between the movie and the recipient from enjoying watching differently, as it can be used in the field of cinema, animation and video games, which in turn helps to form cultural and social awareness through ideas and information that You put it up to form emotional thought.

Second; from one of the other applications on the private virtual reality about the Palestinian urban environment, it was found that the virtual reality system has the advantage that it can be absorbed from different groups of people regardless of their level of educational attainment, because it simulates the real environment in which a person lives in his daily life, meaning that he is not considered Its results are an alien and strange system that does not require the exhibitors to have any training to dive in and understand its virtual environment, using the virtual reality system, it is possible to direct the various paths of the systems in a way that serves the general view of the city, and to provide the most beautiful scenes possible and views to its users, It is also possible to take advantage of the virtual reality system by setting real scenarios for the operation and maintenance process and the expected problems.

Third; the virtual reality system can also be used to monitor and manage field operations of the armed forces with their subsidiary bodies. And a demonstration of its ability to interact instantly with events to manage field operations, as it proved that using virtual reality in global experiences succeeded in achieving the desired goals from its founding.



What are the applications of virtual reality in the field of electrical engineering?

In general, it was concluded that the use of virtual reality to solve problems in electrical engineering systems works to enhance work efficiency and increase accuracy, and also helps in implementing proposed solutions and projects more quickly and efficiently.

Conclusion:

The new technologies have provided tremendous opportunities to modernize the electricity network, which would provide improved communications between consumers and operators in the areas of transport and distribution. This communication layer defines the associated enabling technologies and the infrastructure needed to provide electricity and solve its problems through virtual reality technologies, and it is estimated that the full capacity virtual reality technologies will bring significant net benefits to society through the ability to manage electricity transfers, distribution and consumption more efficiently, in addition to the inclusion and integration of distributed energy generation technologies along with renewable and intermittent sources of fuel in order to solve problems in electrical engineering systems.

This study came mainly to identify the possibility of using virtual reality techniques to solve problems in electrical engineering, where the reliance on the descriptive approach relied on previous studies to reach the required results.

After collecting data, it was concluded that virtual reality has a high ability to confront and address the problem of electrical engineering, and that virtual reality works to enhance work efficiency and increase accuracy, and also helps in implementing proposed solutions and projects more quickly and efficiently.



Recommendations:

1. Regulators should use props at their disposal to promote the use of virtual reality technologies based on the principle of maximizing the system's net benefits (in exchange for only lower investment costs)
2. Regulators should develop efficient pricing systems for generating distributed energy, and approve the use of the resource allocation system as a type of public benefit.
3. Regulatory authorities should require utilities companies to develop privacy policies and apply them to data management, to introduce these policies and to encourage utility companies to promote them to consumers through the use of virtual reality technologies and marketing to them through computers and the Internet.

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