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Significant applications of virtual reality for COVID-19 pandemic

Ravi Pratap Singh^a, Mohd Javaid^{b,*}, Ravinder Kataria^c, Mohit Tyagi^a, Abid Haleem^b, Rajiv Suman^d^a Department of Industrial and Production Engineering, Dr B R Ambedkar National Institute of Technology, Jalandhar, Punjab, India^b Department of Mechanical Engineering, Jamia Millia Islamia, New Delhi, India^c School of Mechanical Engineering, Lovely Professional University, Jalandhar, Punjab, India^d Department of Industrial & Production Engineering, G.B. Pant University of Agriculture & Technology, Pantnagar, Uttarakhand, India

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ABSTRACT

Background and aims: During COVID-19 pandemic, researchers are using innovative technologies for fast-tracking the development to end this menace. Virtual Reality (VR) also offers an imperative role for fighting this pandemic, through audiovisual-based virtual communication.

Methods: A brief study on Virtual Reality and its applications for the COVID-19 pandemic is carried out by employing keywords as Virtual reality or VR and COVID-19 from the databases of SCOPUS, Google Scholar, PubMed, Web of science Academia and ResearchGate.

Results: VR is beneficial for remote sites for exploring telemedicine, planning, treatment, and controlling of the infections by providing proper awareness to the people regarding this disease.

Conclusions: VR technology develops a platform to reduce the face to face interaction of doctors with the infected COVID-19 patients. Through live video streaming, it helps to improve surveillance systems on the ongoing situation.

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1. Introduction

Virtual reality (VR) is defined as developing simulated expertise which is somewhat similar to the real-time situation. In 1994 first virtual reality-based modelling language was first projected, and used for humanizing the virtual world to overcome the craving over headsets. There exists a vast range of applications offered by this technology, namely; medical training, video gaming, military purposes, etc. Moreover, the virtual reality is an imitation by utilizing the computer/communication devices beyond the boundaries. The majorly employed constituents for the development of virtual reality are the input tools, output devices, and the graphical interface software [1,2].

The first virtual reality-based environment, for the learning and handling of surgical treatments, has been originated in the 1990s and reported VR as a very cost-effective approach which also allows the medical learners to identify and minimize the errors that occur at any stage of their learnings. In the 20th century, the concept of virtual reality had further been employed in physical recuperation cases where it has again been proven as a superior quality approach along with the high effectiveness [3,4]. In recent years, the conception of virtual reality has been broadly employed in the domain of the health sector and effectively proposed in various diseases too. Healthcare in a virtual environment offers the implementation of all the structures of VR activity, namely; period, rigorousness, feedback type, etc. based on the sort of treatment and capability of an individual.

In the ongoing pandemic COVID-19 situation, the features and theories proposed by the virtual reality conception can be quite useful in healthcare-related applications and therefore can be effectively employed over to solve or confront many of the issues arising nowadays [5,6]. The proposed concept of virtual reality will also help provide useful learnings to the COVID-19 medical staffs, which will ultimately improve the efficiency and the accuracy of the healthcare service throughout this pandemic COVID-19. The discussed advantages of virtual reality can play a vital role in

* Corresponding author.

E-mail addresses: singhrp@nitj.ac.in (R.P. Singh), mjavaid@jmi.ac.in (M. Javaid), kataria.ravinder07@gmail.com (R. Kataria), tyagim@nitj.ac.in (M. Tyagi), haleem.abid@gmail.com (A. Haleem), raje.suman@gmail.com (R. Suman).

<https://scholar.google.co.in/citations?user=siVGbwEAAA&hl=en> (R.P. Singh), <https://scholar.google.co.in/citations?user=rlyiwvsAAA&hl=en> (M. Javaid), <https://scholar.google.co.in/citations?user=TUBCG7gAAA&hl=en> (R. Kataria), <https://scholar.google.co.in/citations?user=yQxqibUAAA&hl=en> (M. Tyagi), <https://scholar.google.co.in/citations?user=4047148AAA&hl=en> (A. Haleem), <https://scholar.google.co.in/citations?hl=en&user=A3tEW98AAA> (R. Suman)

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effectively and fruitfully solving the cases during ongoing pandemic COVID-19 positively. Fig. 1 shows the necessary tools required for the proper implantation of the virtual reality approach for COVID-19.

2. An overview of the virtual reality concept

In the past decade, providing healthcare-related education is one of the most vital applications of virtual reality in the domain of medical science. The learning of fracture structure, overall skill development of medical residences, concerns of patient safety and care, ethical views, study support to medical scholars, etc. are the list a few real-life merits attained by employing this emerging concept called as – virtual reality. The simulation-based teaching-learning concept further makes this tactic more practically feasible to explore more new applications of the real world. Based on the past practices made in the domain of medical-related learning, it is always suggested and advised to edify the physicians with the opted simulation contrivances and practices. Some successful, relevant practices attempted are; intrusive hemodynamic observing, ventilation handlings, medical education issues, etc. [7,8]. These practices ultimately make the working of medical practitioners improved and effective in terms of their working style and flexibility. In the healthcare sector, the training and learning practices based on proposed simulation-based techniques are further observed and suggested as benign, replicable, and economical too.

Practically, the virtual reality systems are possessing the VR headsets or multiple projection environment which enables the user to feel, sense, interact with the created realistic like atmosphere which is quite helpful in learning and handling the real-time problems/cases more productively. Classically virtual reality incorporates acoustic and video response, but may similarly permit other kinds of sensual and force response by employing the haptic approach.

The learning of medical practitioners can also be improved and developed by providing them with the opportunity to handle the imitation kind of cases over the originated virtual reality background [9,10]. The primary key benefits offered by offering the VR approach based learnings to the medical domain scholars are explicated in Fig. 2.

3. Working process of virtual reality for COVID-19

The concept of virtual reality is proved for providing a bunch of applications for healthcare and attracting medical practitioners by offering them various uses in the core area of healthcare and

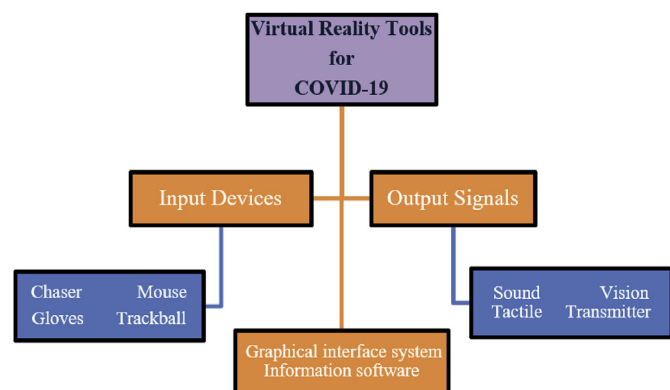


Fig. 1. Virtual reality tools for the proper implementation in COVID-19.

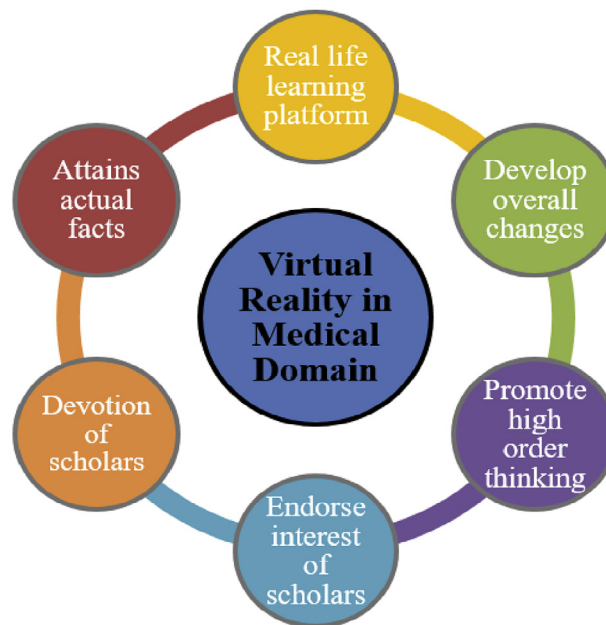


Fig. 2. Merits of virtual reality approach in educating medical personals.

treatment [11–15]. There are several ways in which the concept and process of VR are helpful in context to mitigate effects of COVID-19. Fig. 3 is demonstrating the various advantages in the execution of the virtual reality concept in fighting the COVID-19 pandemic. The following are some of the proposed majorly emerged concerns to make the healthcare domain trained and more proficient.

- Through medical training
- Patient treatment
- Medical marketing
- Disease awareness

3.1. Through medical training

The proper and effective COVID-19 medical staff training will make the physician quite familiar with the actual case and the exact situation to be handled. Virtual reality offers the doctors or medical personals to withstand and practice all the most complex cases by supporting them to have reachability as similar to real patient handling, as the case may be. This support creates a more analogous environment where the physicians and health workers can learn more quickly and positively to handle the issues with care and proper learning. In this way, the cooperation named as *medical realities* is practically employing the virtual reality culture intending to deliver superior quality training for the handling of surgical cases. It ultimately utilizes and offers an interactive and immersive experience.

3.2. Patient education

The impressive facilities employed and offered in a virtual reality approach, educate not only the healthcare personals but also its ultimate beneficiaries, i.e. patients. This theme also enhances patient satisfaction as well as provides the doctors with a vast work gratification too. In the case of surgery based treatments, its efficacy gets multiplied [16–19].

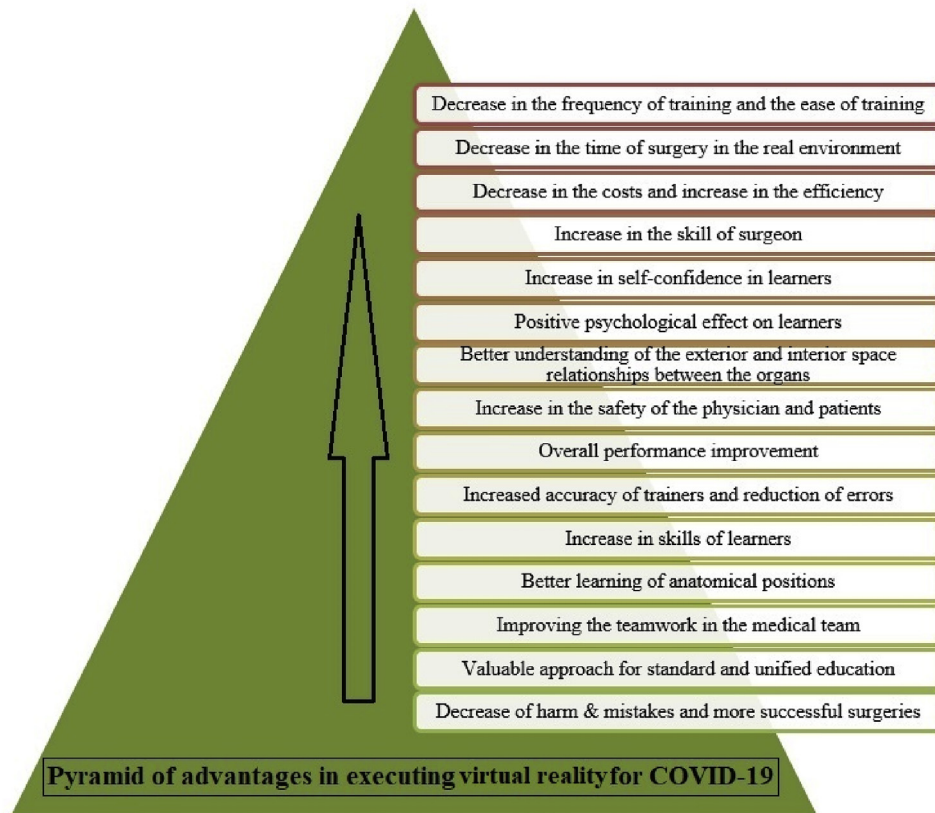


Fig. 3. Several key-advantages in executing the VR approach for COVID-19.

3.3. Mental and psychological treatment

The extreme cases where difficulties in terms of psychological behaviour took place, the concept of virtual reality is proven as a powerful tool in those cases too. After passing through such an extreme pressure of pandemic like COVID-19, these patients also undergo some psychosomatic disturbances. In those cases, the VR methodology can become quite helpful and significant too.

3.4. Management of pain & physical therapy

Apart from the based surgical treatment and psychosomatic cases, the virtual reality concept also proved superior while handling discomfort and physical therapy too [19–21]. The created virtual training and learning atmosphere helps the sufferer to heal more quickly and sharply. This ultimately reduces the overall recovery time and enhances the patient's satisfaction.

4. Significant applications of virtual reality for COVID-19 pandemic

Virtual reality has been revealed as a topical invention of the digital field. It is rapidly changing the traditional way of medical learning methodologies and case handling approaches [22–26]. The concept of VR employs computer-based engineering and techniques to create a virtual working environment. Table 1 explicates the significant applications of VR for the COVID-19 pandemic.

5. Challenging issues and future scope of the study

Some of the reported techniques are well proven; however, some of them are also in starting phases too. The coming time is going to be more challenging and competitive for a virtual reality approach in terms of its effectiveness, precision, economic facts, etc. More creativity and sharpness while applying these theories and facts of virtual reality in the real database environment would always be requisite. The further virtual reality application should be targeted over the formation of specifically planned rooms providing with several bigger screen fronts additional to the presently existing small camera screen front in the virtual reality headsets. There have been reports on growing market opportunities for the virtual reality concept to explore itself in the required healthcare domains, especially in the present epidemic situation. This also expresses the proposed utility of the digital and telecommunication facilities in conjunction with the software technologies to answer the critical issues arising out in the present COVID-19 epidemic.

6. Conclusion

As a concluding remark, the concept of virtual reality has been broadly employed in the domain of the health sector and effectively proposed in various diseases too. This approach provides an extensive edge to defend and confront the present epidemic COVID-19 by enhancing the skill, confidence, performance, and overall attitude of healthcare persons. The offered features make a significant improvement in ongoing learning and case handling strategies. It is used as a complementary medical/healthcare edify tool will enhance the execution of medical deliverables. With

Table 1
Various applications of VR in context to COVID-19 pandemic.

| SNo | Applications | Description |
|-----|--|---|
| 1 | VR for Physical Therapy | The concept of virtual reality can handle cases of physical therapy more effectively and impressively. |
| 2 | VR for Pain Management | Virtual reality productively helps COVID-19 patients with chronic pains to achieve relief. |
| 3 | VR based mobile application for COVID-19 | VR-based mobile applications help in the treatment of infection diseases that helps in solving a lot of medical problems. |
| 4 | VR based stay for patients during long in-hospital treatment | Virtual reality approach based glasses can help to get rid of any stress caused by staying at the hospital. |
| 5 | VR for Physical Rehabilitation | COVID-19 patients recoveries will be faster when using virtual reality-based recuperation therapies. |
| 6 | VR for Cognitive Rehabilitation | This technology can immensely help people suffering from cognitive issues or social anxiety. |
| 7 | VR for Distracting Patients | VR headsets can be used to focus on entirely different things and make medical treatment less stressful. |
| 8 | VR for Treatment of Psychological Disorders | VR can be hugely successful in treating patients with fear, phobias, or other psychological disorders. |
| 9 | VR to Aid in Complex Operations | VR helps in planning for intricate surgeries pertaining to vital organs and many other unique cases with no precedence. |
| 10 | VR for Healthcare Professional Training | VR possesses the capability and power to take doctor training regarding COVID-19 virus |

proper implementation of this approach, researcher, doctors, government, academicians can form a healthier atmosphere to compete with this disease. The concept of virtual reality includes the overall enhancement in the accuracy and the efficacy of the adopted actions, improved working proficiency, well trained medical staffs, etc. which can play a vital role in effectively and fruitfully handling the ongoing pandemic COVID-19 cases positively.

Declaration of competing interest

None

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