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Significance and Application of Robotics in the Healthcare and Medical Field

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Abstract

Technologies have a great impact on the Healthcare and medical sectors as this helps the professionals to boost their productivity and efficiency to a great extent. Robotics has a great influence on the entire activity of the health care sector and this has the capability of changing the entire workflow. With the assistance of robotics and artificial intelligence HealthCare professionals upgrade their day to day operation and provide best patient care for the betterment and first recovery of the patient. In the majority of cases robots are eventually used to make the surgeries and the recovery of the patient more effective and impactful. On the other hand, this also has the pharmaceutical and other Healthcare systems to meet the demand of the market place with the help of enhanced productivity and efficiency. Despite the advantages there are a number of different challenges and disadvantages are also involved with the overall implication of robotics in the healthcare and medical field. The challenges which are associated with the application of robotics in healthcare have been discussed critically within the study. The process to mitigate issues and avail most significant assistance through robotics in the medical sector has also been discussed with the entire study.

Index Terms

Robotics, healthcare, productivity, efficiency

INTRODUCTION

Technology has a great influence on healthcare and in other sectors of the medical field and this has the capacity to change the traditional way of providing healthcare to the patients. Incorporation of advanced technology has to improve patient care and this also helps to efficiency in hospitals. Utilisation of robotics and artificial intelligence is increasing rapidly as these have the strength to change the game in the healthcare and medical sectors. Industrial robots are greatly used to boost the productivity and efficiency of the healthcare sectors and this also helps to save time and effort of human individuals. In the year 2021, the global medicine market was valued nearly around $ 16.1 billion dollars and by looking at the demands and current market trends it is expected to rise up to 17.4 by the year 2023 [1]. Robots are used in several purposes in healthcare sectors such surgical and rehabilitation are often utilised for treatment purposes, and assistive robots and therapeutic robots are incorporated into the healthcare for recovery from severe illness like, stroke.

The utilisation of automation and robotics is capable of changing the efficiency of the operation of laboratories and this eventually makes the activities more organised and less time consuming. On the other hand, this helps the healthcare organisation to boost their quality of the services to ensure greater patient care support and this in turn accelerates the entire process of care giving. Apart from that automation, mobile robots help the management to reduce the immense workload and thus facilitate greater productivity and efficiency [2]. These robots have the strength to fulfil the staff-shortage and also allow the managers to manage inventory to great extent. Moreover, it is clear that this helps the management to establish a safer environment in the workplace. Incorporation of robotics in healthcare is beneficial for both management and for the other workers as it helps to ensure that transportation of suppliers and other essentials in hospitals is completely safe where the chances of contamination of pathogens are higher.

Figure 1: Application of Robotics in healthcare

Robotics and automation is used in pharmaceutical industries and this makes the operation fast and effective. Often robots are used in the mixing of drugs, dosing, and packaging and cobots also help the workers to maintain their work life balance and upgrade their productivity. Most essentially the automatics and robotics help in the lab work, testing drugs, and ultimately makes the overall process robust [3]. It is clear that automation and robotics is the future of healthcare as this has the ability to transform the entire process of healthcare systems to a great extent. It is true that

robotics allows the healthcare and other medical sectors to meet the increasing demands of the marketplace and secure their place in the global marketplace. This technology is a revolutionary element that eventually acts as the catalyst to boost the quality of the services and makes the process more concrete and effective.

MATERIALS AND METHODS

Methods and materials are the most essential elements that possess the ability to secure the success of the study. Selection of suitable and right techniques determines the future of the study and also secures the success factor greatly. Right technique and tools help the researchers to explore the subject matter and uncover the aspects and information to create better understanding on the subject matter [4]. Qualitative rescuers design has been incorporated to successfully fulfil the demands of the study and this also helps to seamlessly and effectively carry out all the study in the right direction. On the other hand, secondary research types have also been chosen to ensure successful completion of the study on time. One of the major advantages of qualitative research design is that this helps the researchers to understand all the aspects related to the subject matter in a less complicated way.

Secondary data has been collected to accomplish the study seamlessly and effectively from reliable and authentic sources. All the crucial data has been gathered from the peer-reviewed journals and articles and other authentic sources such as websites to ensure successful accomplishment of the study. Inductive research approach has also been used to assess all the possible aspects of the topic to generate new theories for the sake of successful accomplishment of the study. Additionally, it has also ensured that all the secondary information has been gathered related to the application and significance of robotics in healthcare and no primary data have been utilised in this particular study. Information has only taken from those secondary data that has been published after the year 2019.

RESULTS

Application of robotics in healthcare and medical fields

Robotics has brought an extensive change in the healthcare sector; for instance, ways of performing surgeries are ameliorated by the application of robotics. Despite this, disinfection and supply delivery are streamlined by different robots utilised in different hospitals and nursing homes. In recent days, healthcare providers have become more aware of providing better treatment to patients and in this case, robotics carries a great significance in the field of aiding these individuals to ensure improvement of patients' health conditions. Robots are used in several fields of the healthcare sector and in every field, it is capable of boosting productivity of the organisation [5]. With the assistance of robotics, healthcare institutes can effectively increase the efficiency of the day to day operation. Medical robots are capable of simplifying clinical workflow and logistics and most essentially it improves the patient care to a great extent.

Figure 2: Application of robotics in healthcare sectors

Robotic applications are capable of improving the overall effectiveness of the hospitals in terms of boost efficiency and flawless activity. It is evident that an AI algorithm has the power to carry out a wide range of medical operations remotely. There are several types of robots that are widely used for the sake of better services in the healthcare sector. Mobile robots are capable of disinfecting the surgical room, transportation of the essentials and patients, or machinery [6]. Apart from that often social robots are used to boost the morale of the patients as these robots have the ability to chat with humans. Social robots or rehabilitation robots are programmed with the aim to ensure that the robots are capable to adopt the condition of each and every patient as the individuals are healing from critical illness such as stroke, traumatic brain or spinal cord injuries or other severe diseases.

On the other hand, usage of robotics helps the organisation to fulfil the shortage of staff and reduce the excessive workload of the workers. Service robots are often used to manage inventory of the organisation. This has the ability to manage inventory effectively and ensure the organisation has enough stock that is required to fulfil the demand of the patients. With the assistance of service robots Healthcare professionals can solely focus on the betterment of the patient and their treatment instead of worrying about other factors. In some of the cases healthcare professionals also utilise robotics to perform complicated surgeries to ensure success in the process [7]. It is evident that surgical assistant robots are expanding in number and this in turn increasing the utilisation of AI to a great extent. In the past few years the number of robots in the healthcare industry has expanded dramatically and in this scenario Covid-19 have acted as an active catalyst.

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Figure 3: Disinfection robots

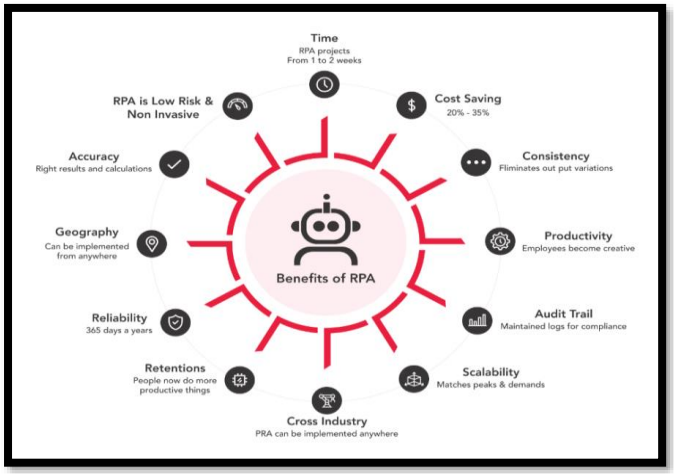

Figure 4: Advantages of robots in healthcare

During the time of pandemic, she post pandemic the demands of robots has been increased immensely as the work mode has changed and the work pressure have also been increased to a great extent. During the time of pandemic, the world has identified the strength of AI and robotics and the professionals have also identified the scope of robotics in healthcare sectors [8]. The Corporation of Robotics has effectively changed the entire game in the healthcare sector and this has also provided the much-needed support in terms of greater productivity and seamless and fast treatment after the speedy identification of disease. With the increasing number of antibiotic resistance bacteria and outbreak of deadly viruses such as Covid-19 and Ebola most of the healthcare institutes are utilising robots to clean the rooms and all floors of the healthcare organisations are disinfected. Sanitation and disinfection robots are specifically appointed to perform these types of activities and reduce the excessive work pressure of the workers.

Benefits of robotics in healthcare and medical field

One of the key advantages of incorporation of robotics in healthcare is the improved services and fast and effective treatment. AI and robotics are considered as the major technologies that have the potential to impact the healthcare industry and this also possess the strength to mitigate all the problems. In the past few years the utilisation of robotics has increased to a great extent and this has changed the game to great extent. In the medical sector, robots are changing the traditional ways of surgeries to a great extent and this has had greater efficiency and accuracy in the process [9]. With the assistance of robotics healthcare professionals effectively maintained consistency and quality of the services and that eventually helped the patients to get better services in terms of treatment. Robots have the ability to make all the healthcare operation seamless and organised and this eventually results in more productivity and efficiency of the organisations.

Robotics has the ability to boost up overall activities of all healthcare related sectors such as hospitals, pharmaceutical companies and so on. With the help of the robotics; pharmaceutical industry effectively reduce the manufacturing time and boost up the entire efficiency of the workforce. On the other hand, this also helps the management to run the seamless and production work process within any unnecessary hassle. With the incorporation of robotics professionals ensure that the process of drug preparation, mixing of the composition and other crucial activities are precious and flawless [10]. On the other hand, robots also help healthcare and other medical sectors to track the record of the patients and manage the data efficiently. In this modern world, robots play an essential role in all fields and in the case of healthcare and medical sectors they act as catalysts and accelerate entire activities to a great extent.

This also helps the professional to reduce the workload of all healthcare professionals and this eventually saves the professional from getting exposed to pathogens by cleaning the surface of all the rooms. During the period of pandemic and post pandemic healthcare professionals are utilising the most of the benefits of robotics for the better of the patients. Incorporation of robotics have less to do with preciseness and this in turn has deeded the time span of hospitalisation, that is helpful for the patients [11]. It is evident that robotics surgeries have several other advantages such as less blood loss of the patients, faster recovery time and so on. This also helps the professional to reduce the chances of failures and on the other hand, encourages flawless performance and decreases the risk of infection. Monitoring of the patients is critical for the healthcare professionals as it has a great impact on the heath of the patients and robots help the professional to reduce work pressure in this scenario. Most of the cases robots are programmed to monitor the patient for ensuring better and speedy recovery. Not only that, this helps the management to manage their inventory effectively and seamlessly to ensure availability of the resources.

Challenges involved with implicating Robotics in the Healthcare and Medical Field

Trust issues of the patients

A person with physical valetudinarians needs to be treated with superior care and needs to establish trust upon the entire medical process of treatment in order to provide superior cure to the victim through ensuring an effective trauma care process. Most of the patients and their family members all around the globe have demanded human care within their treatment process and do not have enough trust in the assistance of robots [12]. The poor trust issue of the individual coming to get treatment has been a critical challenge for the medical institution to use the assistance of robotics and AI in the healthcare field.

Lack of emotional attachment with the patient

The use of robotics not only helps to increase communication but also creates a stumble block to interaction with the patient parties and the medical team within a medical institution. The use of robotics reduces the emotional attachment with the patients as human resources does not perform the necessary interactions with the sufferers within a pharmaceutical institution due to high dependency on the technological assistance [13]. It impacts most negatively on the motivation and confidence level of the patients which reduces their efforts to fight back against the health issues. Though, the lack of emotional attachment with the patients is a key disadvantage associated with the application of robotics in the pharmaceutical and healthcare sector.

Poor knowledge of the medical employees to use robotics and associative services

Most of the technical individuals working in the medical field in recent days have a significantly poor knowledge of accessing the support of robotics within their daily activities. Very few non-medical staff who has contributed their effort to all strategic and operational tasks within a healthcare institution is friendly while using various modern equipment properly such as IoT devices, AI, robotics and many others. The healthcare organization has been facing a critical challenge of gaining the highest contribution and support from robotics due to poor efficiency and knowledge of the lower level human resources to access the assistance of the robotics. It can be considered as a key challenge associated with the entire implication of robotics in the healthcare field.

High maintain cost

The maintenance cost of robots and other relevant equipment to use the help of robotics effectively is critical in the business market. The need for a high amount of investment to implement robotics is unaffordable by a large number of healthcare companies in the global market. It can also bring forth a critical financial loss through increased budget to imply robotics while investing beyond capacity. A large number of business enterprises performing their business in the healthcare and medical field does not invest in robotics due to its high maintenance and implication cost [14]. It can be measured as one of the most significant challenges involving the implication of robotics within the medical field.

Increase Unemployment rate

The escalating rate of dependency on robotics has reduced the job security of the human resources performing their works in the medical sector. An implication of robotics reduced the need of the human resources in various traits and also reduced the number of employees to be worked within versatile departments. Business organizations will not keep a large number of human resources without reason and contribution through availing higher support and assistance from humanoids within working areas. Though, the implication of robotics will cause a high rate of unemployment in the healthcare sector [15]. It is the most critical challenge involved with the implication of robotics within the working periphery of the healthcare institutions.

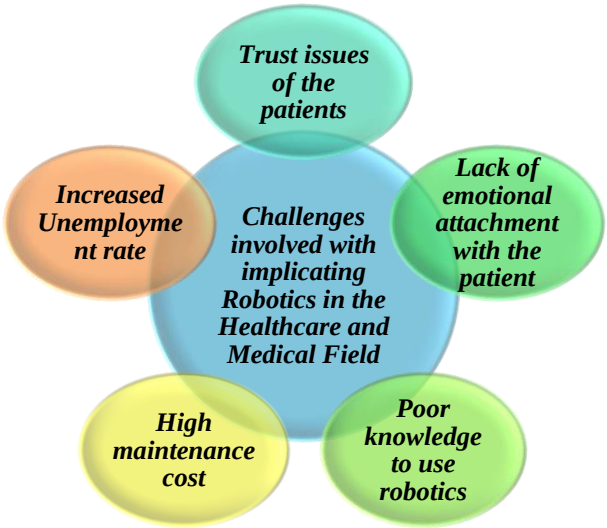

Figure 5: Challenges involved with implicating Robotics in the Healthcare and Medical Field

Process to mitigate issues while using Robotics in the Healthcare and Medical Field

Increase ethical use of robotics

The process of performing the strategic and operational tasks of an enterprise using robotics needs to be performed with high ethical concerns and ideologies. The use of the support provided by the robotics needs to be avail while keeping focus on the needs of the patients. In critical and diplomatic areas, it needs to use human resources instead of humanoid in order to build superhero emotional attachment with the patients and their family members which helps to escalate their trust upon the use of technological support especially in the trait of robotics.

Conduct training to increase the knowledge of using robotics

The poor awareness and knowledge of the employees gaining the assistance of robotics has actually reduced the positive impact of robotics in the healthcare sector. Hence, it has become highly essential for the healthcare institute to conduct various effective training courses in order to improve the knowledge and insights of each human resource while using robotics [16]. It also helps to aggravate the efficiency of the employees within the healthcare sectors and provide the support to avail most significant support from the robotics within the working process of a medical institution.

Ensure job security of the human resources

The fear of job loss reduces the motivation and the involvement level of the employees within an enterprise. The overall implication of robotics in the healthcare sector impacted most negatively on the job security level of each human resource within a healthcare institution. The entire performance level of the employees was reduced due to poor mental state due to the risk of unemployment due to the implication of robotics in the medical field [17]. Hence, it becomes highly essential to ensure job security for the employees in order to gain superior support and contribution from them and avail a superior service through implementing robotics. It will help to gain a higher competitive advantage for a business company in the medical and healthcare field.

DISCUSSION

Technology plays an essential role in the healthcare and medical sector as this has the strength to transform overall activities to a great extent. Upgraded Technology such as robotics and artificial intelligence helps the healthcare industry to grow rapidly and provide best service to their patients for their speedy recovery. In this modern world, utilisation of robotics and artificial intelligence allows Healthcare professionals to provide best Healthcare services and ensure accurate and on time treatment to reduce the hospitalisation period. By looking into the present scenario it is clear that the number of utilisation of Robotics in Healthcare is increasing rapidly and the market is expanding to a great extent and it is expected to grow 17.4 billion by the year 2030. One of the major reasons for utilising Robotics within the hospitality sector is the enhancement of the productivity and efficiency of all the operations in the hospitality and medical sectors.

With assistants of automation and Robotics medical professionals effectively improves their productivity and the quality of services that intern allows the professionals to ensure betterment of patients to a great extent. Apart from that Robotics helps professionals to reduce the work overload and boost the productivity of the workers. In hospital and other medical sectors robots are used for several purposes, often robots are used to assist surgeries or ensure seamless clinical work flow or to make the inventory management effective and hassle free. Mobile to watch helps to manage the efficiency of the overall work flow and this also have to doesn't fact the surgical room transportation of the necessary goods and this also helps to transport machinery within the organisation. Apart from that, social or rehabilitation robots help the Healthcare professionals to reduce the work pressure of the workers as these robots are capable of carrying out effective and successful human communication and this helps the patient to recover from such a stroke or any other mental trauma.

Robots are capable of managing inventory effectively and seamlessly and that intern Herbs the organisation to ensure availability of the medical equipment and all necessary medicines that are required to provide best services to the patient and ensure less hospitalisation time and speedy recovery of the patients. It becomes essential for the management to ensure that the stop is appropriate and has the capability of fulfilling the demand of the patient to prevent less time consumption at a time of treatment. Robots accelerate the overall activities and do eventually help management and health care professionals to provide best service seamlessly and on the other hand, this eventually impacts patients to a great extent. In the case of pharmacies and other medical sectors Robotics helps the professional to uplift their entire process and ensure best quality of the product and services. By implementing robotic and artificial intelligence within the company, the pharmaceutical industry shares greater productivity and seamless manufacturing that is capable of meeting the demand of the marketplace. This has the ability to change the entire game in the healthcare system in forthcoming years to a great extent.

CONCLUSION

In this 24th century Technology please and effective role in all the industries and Healthcare system is not different from others. Incorporation of robotics and AI helps the business to fulfil the demand of the Marketplace and to secure their place in the competitive world. It has been seen that incorporation of Robotics eventually helps the industry to grow rapidly with the help of the advantages of the technology and this also allows the sectors to boost their overall effectiveness to a great extent. Healthcare robots have effectively changed that traditional way of surgeries and

this have also helped the professionals to increase the success rate and decrease the risk factor. On the other hand, robots are also being used to sanitise the loss and the other you tell sell to ensure greater success of operation and other activities and this also helps the organisation to reduce the chances of contamination.

One of the major reasons for incorporation of Robotics within the day to day health care operation is the accuracy and reliability that this technology brings to the table. Robots are also capable of tracking all the details of inventory and ensure better and advanced inventory management that is seamless and effective. In the Healthcare system robots are also used to boost the success rate and it is less painful compared to traditional surgeries and the blood loss of the patient is also compared less from the traditional surgeries. Despite the advantages there are some challenges that are faced by both patient and the Healthcare professional that is lack of emotional attachment and trust is often faced by both the parties. Not only that there are other issues such as lack of appropriate knowledge and equities of the employees that are liquids to assist or utilise robotics to gain the advantages of the technology and on the other hand the maintenance cost is something higher than anticipated that makes the overall process expensive. Orphan these even late to unemployment of the human resource that eventually impacts the wellbeing of the Healthcare workers. Although with the assistance of appropriate training and management policies, all the issues can be mitigated effectively.

REFERENCES

[1] Crawford. M, 6 Applications for Robotics in Medicine, *THE AMERICAN SOCIETY OF MEDICAL ENGINEERS*, 24th January. 2023. https://www.asme.org/topics-resources/content/top-6-robotic-applications-in-medicine

[2] Fragapane, Giuseppe, et al. "Planning and control of autonomous mobile robots for intralogistics: Literature review and research agenda." *European Journal of Operational Research* 294.2 (2021): 405-426.

[3] Roper, Katherine, et al. "Testing the reproducibility and robustness of the cancer biology literature by robot." *Journal of the Royal Society Interface* 19.189 (2022): 20210821.

[4] Braun, Virginia, and Victoria Clarke. "Conceptual and design thinking for thematic analysis." *Qualitative Psychology* 9.1 (2022): 3.

[5] Das, Sanjoy, et al. "Advance machine learning and artificial intelligence applications in service robot." *Artificial Intelligence for Future Generation Robotics*. Elsevier, 2021. 83-91.

[6] Barua, Ranjit, and Sudipto Datta. "Modernization of Robotics Application in 21st Century: A Review." *Journal of Mechanical Robotics* 5.2 (2020).

[7] Dwivedi, Prashant Kumar. "Mobile Robots in COVID-19." *Use of AI, Robotics and Modelling tools to fight Covid-19*. River Publishers, 2022. 59-78.

[8] Sarker, Sujan, et al. "Robotics and artificial intelligence in healthcare during COVID-19 pandemic: A systematic review." *Robotics and autonomous systems* 146 (2021): 103902.

[9] Fatima, Shaiba, et al. "Exploring the significant applications of Internet of Things (IoT) with 3D printing using advanced materials in medical field." *Materials Today: Proceedings* 45 (2021): 4844-4851.

[10] Mushtaq, Farwa, et al. "Preparation, properties, and applications of gelatin-based hydrogels (GHs) in the environmental, technological, and biomedical sectors." *International Journal of Biological Macromolecules* (2022).

[11] Seto, Theodore P., and Dhammika Dharmapala. "An Empirical Assessment of the Likely Impact of the International Provisions of the TCJA." *Jotwell: J. Things We Like* (2019): 1.

[12] Kumar, Pranjal, Siddhartha Chauhan, and Lalit Kumar Awasthi. "Artificial Intelligence in Healthcare: Review, Ethics, Trust Challenges & Future Research Directions." *Engineering Applications of Artificial Intelligence* 120 (2023): 105894.

[13] Vallès-Peris, Núria, Oriol Barat-Auleda, and Miquel Domènech. "Robots in healthcare? What patients say." *International Journal of Environmental Research and Public Health* 18.18 (2021): 9933.

[14] Khorgami, Zhamak, et al. "The cost of robotics: an analysis of the added costs of robotic-assisted versus laparoscopic surgery using the National Inpatient Sample." *Surgical endoscopy* 33 (2019): 2217-2221.

[15] Nissim, Gadi, and Tomer Simon. "The future of labor unions in the age of automation and at the dawn of AI." *Technology in Society* 67 (2021): 101732.

[16] Chen, Mei, and Michel Decary. "Artificial intelligence in healthcare: An essential guide for health leaders." *Healthcare management forum*. Vol. 33. No. 1. Sage CA: Los Angeles, CA: SAGE Publications, 2020.

[17] Johnson, Anya, et al. "A review and agenda for examining how technology-driven changes at work will impact workplace mental health and employee well-being." *Australian Journal of Management* 45.3 (2020): 402-424.