Robotic Human Interaction

[Author’s name]

[Institute’s name]

**Abstract**

Human interactions have changed because of technological innovations, including human-like robots. These have made easier, our daily routine work and have helped us to achieve our goals or objectives. This study aims to understand and analyze human-robot interactions with the help of SWOT analysis. SWOT analysis helps to understand strengths, weaknesses, opportunities, and threats. While this study, aims to critically analyze the existing association between human beings and robots. It focuses the opportunities and strengths; which human-like-robots have created for humans considering the overall spectrum of interaction. However, there are some threats to humans in terms of availability in opportunities, ethical and moral issues. These specific concerns appeared due to specific concerns such as communication gap between people and their families, robots have replaced humans in every sector of life. The government has to limit these innovations to avoid issues and conflicts of humans caused by these robots.

Robotic Human Interaction

**Introduction**

In recent times, technological advancements are continuously doing wonders for human beings, in different manners. Undoubtedly, today’s human life can never be imagined without the active role of technology. It is interesting to examine how much technology takes control of people’s lives. The splendid effects of technology can be observed in many diverse forms, that eventually alter the functioning of human beings. The broad idea of innovation can never be considered complete, without the approach of robots. The creation of different forms of robots, recognized as one of the major technological development in the history of mankind as it transform organizational operations dramatically. This phenomenon, dramatically changed the thinking and functioning of the world concerning the idea of innovative development. The growing trend of robots in different aspects of life, ultimately made work tasks easier for human beings. The technology of robotics is a popular trend that requires deep consideration of different associated factors. The practical approach of robotics covering particular aspects such as the design, development, operation, and actual use of robots, as the substitute of humans in various forms. The central agenda in the case of robotic technologies is to ensure the development of different machines that can successfully replace the actions of humans. The entire explanation of robotic technology is not possible without focusing on the concept of human-robot interaction. It is one growing idea that grabs the attention of researchers and scientists in an immense manner. Experts are keen to illustrate and develop improved practical dimensions when it comes to applying the idea of robotic human interaction. Moreover, it is also necessary to examine different relevant features. This paper focuses on critically examining the feasibility of human-robotic interaction by analyzing the prospects of SWOT analysis and financial considerations.

**Discussion**

The development and functioning of robots was the breakthrough, chiefly, in the industrial sector. It gives some powerful new dimensions to the field that eventually become the reason of product and profit maximization. It is important to examine how human beings initiated their approach to develop a connection with automated machines. This form of consideration, can be better revealed under the phenomenon of human-robotic interaction.

**Introduction to Human-Robot Interaction**

From a broad perspective, human-robot interaction is recognized as a vast field that comprised of multidisciplinary aspects. It is defined as the area that is focused on understanding, designing, and assessing the total domain of the robotic system for use by or with human beings. When it comes to the objective of interaction, then it involves a proper form of communication between robots and humans. The prospect of robotic-human interaction is closely linked with the practical approaches of computer interaction, robotics, natural language domain, design, artificial intelligence, and the overall spectrum of social sciences. Interaction between robots and human beings can be observed by considering many different forms of action. It is noteworthy to indicate that all these practical forms link with the examination of proximity between human and robot.

The idea of interaction or communication between robots and humans, is mainly established, considering two main categories of remote interaction and proximate interaction. Both these paradigms played a critical role to determine the degree of association between the automated form of robots and human beings at various levels of communication. The practice of remote interaction appear when robots as mechanical instruments are not co-located and parted from humans temporarily or permanently. The robots in the form Mars Rovers are the best examples in this context that completely separated them from Earth, in forms of both space and time. However, the prospect of interaction in this manner can be avoided completely. Contrary to this, the idea of immediate interaction between humans and robots is established, once these aspects are co-located. The functioning form of robots in the service sector can be characterized as a suitable example of the approach of proximate interaction.

  The scientific study of human-robotic interaction is helpful to successfully recognize existing differences between the aspects of applications. The practical approach demands mobility, physical manipulation, and the prospect of social interaction. The idea of interaction-based mobile robots are also recognized as teleoperation. This idea is utilized to develop supervisory control, for the operations of robots. On the other hand, a remote association with a physical manipulator is defined as its position as the paradigm of telemanipulation. The objective of proximate interaction can be attained through the platform of robot assistance with the active involvement of physical association. The facet of social interaction involves the main features of social, emotional, and intellectual forms of association. The approach of social interaction is interesting because the interaction of robots and humans are recognized under the spectrums of peers or acquaintances. Under the concept of social interaction, robots are bound to play their role as the companions or assistants of human beings, to perform different job tasks. This idea of interaction ranges as the proximate, instead of the remote form of association.

Diverse forms of interaction between humans and robots require a detailed assessment of people’s behaviors, thoughts, and attitudes when it comes to developing strong interactions with automated machines as robots. The extensive concept of robotic-human interaction involves active consideration of different related aspects that requires necessary attention. The central objective of this practical approach, is to ensure the development of robots that can play their role as the facilitator in the overall scenario of human-robot interactions.

**Practical Aspects of Human-Robotic Interaction**

The phenomenon of interaction between robots and humans can be practically observed, considering many different dimensions. The field of human-robotic interaction (HRI) defined as one extensive approach that requires active consideration of different associated factors. Currently, the practical idea of human-robot interaction can be observed in the case of many different fields. For example, piloting aircraft is one major concern for years concerning the spectrum of useful interaction between humans and machines. Human aspects in the forms of behavior and attitude can be successfully regulated by examining different dynamics and control mechanism appears in case of human-robots interactions. The facet of human interaction, in the case of robots, can be observed in various operating phases such as the domains of research, conceptual design, and overall assessment.

**Main Areas of Application**

Identification of main areas of application of human-robotic interaction, is an essential measure to recognize the actual implications of the contemporary idea of an association between human beings and robots. It is important to indicate that the facet of interaction can be established in many different forms, according to the specific requirements. The facet of interaction between humans and robots can be mainly applied, in the form of four main areas.

Supervisory control by human beings, in the case of the performance level of robots, is one major practical form of interaction that exists in the form of human-robotic interaction. This perspective exists, concerning the perspective of routine tasks performed by robots, as assisting human beings. This form of application can be observed as the proper handling of production assembly lines and ensure the successful delivery of manufacturing packages. The idea of association, in the form of human supervisory control of robots, can also be examined in the fields of medicine, warehouses, corporate offices, and healthcare organizations. The robots used for these services are recognized as Telerobots, that are responsible for carrying out a limited form of actions, in an automatic manner. This form of application is performed by following instructions of a computer program. This practical domain, made it possible for robots to correctly assess the need of the environment and utilize its joint positions of communication in the form of computer guidelines, updated by human beings.

 The interaction between humans and robots is also observed in the form of remote control spectrums adopted by human beings. This form of application is mainly established in the areas of space, airborne, undersea automobile vehicles. This form of interaction is successfully observed, mainly in case of various non-routine responsibilities. When it comes to consideration of risky or inaccessible environments, this form of association between robots and humans is worthy of addressing severe working conditions. This form of the robot is recognized as a teleoperator, under the domain of manipulation and mobility tasks. The main prospect of this form of consideration is observed, referring to the idea of the remote physical environmental spectrum. An automated vehicle is another major approach that causes the active consideration of human-robotic interaction. This practical approach appeared in the situation when humans play their role as the passenger, and associated with robots to assure successful acquisition of different tasks. Automated highway, commercial aircraft, and rail automobiles are some prominent examples of active association and interaction between human beings and robots. The central aim of this form of interaction, is to meet the objectives of automation effectively and efficiently.

  Social interaction between humans and robots is another central form of application in the form of human-robotic association. In this spectrum, the role of robots is diverse concerning the provision of services to human beings for their convenience. The provision of different entertainment services by robots, is one significant example of human-robotic social association or communication between human beings and machines. The social interaction as the service can also be successfully applied in the areas of teaching, assisting people who are unable to perform their routine tasks.

**SWOT Analysis of Human-Robotic Interactions**

The significance and effectiveness of human-robotic interaction are only possible by critically examining different related aspects. The usefulness of this form of association, can never be examined without focusing on various domains of consideration. The broad idea of human-robotic interaction involves practical consideration of various strengths, weaknesses, opportunities, and threats. The researcher needs to conduct prior research, to critically identify and examine these specific factors to determine the actual suitability of the concept of communication between humans and robots.

**Strengths of Human-Robotic Interactions**

The domain of strengths, in the scenario of human-robotic interaction, can be examined in both cases of involvement of human beings and robots, during the association. The combination of the strengths of humans and robots, ultimately helped to meet the extensive standards of the human-robotic association. It is important to notice that the successful idea of collaboration between humans and robots consisted of the strong application of different interrelated aspects. The major strengths, in the case of human-robots interactions, are established as a successful application of cognitive skills, intelligence, flexible domain, and the ability to successfully act during sensitive situations. These particular aspects can be successfully addressed by focusing on the main strengths of this practice field

  The strengths of human-robots interactions, in the case of the role played by humans, can mainly be observed in the forms of high availability level, successful handling of complex factors, ensuring proper execution of complex procedures, and assuring proper flexibility during the entire phase of communication between humans and robots. The active role of human beings during each stage of interaction with robots, is one of the critical strengths to gain maximum benefits from the process of human-robotic interaction (Thrun, 2004). High availability of humans increases the potential effectiveness of proximity between human beings and robots. Successful application of cognitive domains by humans, ultimately, strengthen the prevailing association in the form of human-robots interactions. Flexibility is another feature that can be observed as strength of human-robots interaction to achieve complex tasks. Flexible involvement by humans ensures the application of diverse means, to enhance the practical idea of communication between automation and human beings.

  The strengths of this active connection between humans and robots can also be observed by examining the strengths of robots in the entire scenario. Integrated process control is one major strength established in the form of the role of robots during the process of human-process control. Successful assimilation of various practical domains helps to meet the significant standards of the overall practical idea of the robots-human association. Moreover, the advanced automated approach, in the form of robots, can handle different complex factors. The overall strength of human-robots interaction, is also observed in the case of the exact execution of defined paths for the robots (Yanco & Drury, 2004). The processing of robots, ensures the application of standard protocols to achieve the desired objectives of human-robots interactions. Reliability is another crucial form of strength that can be established in the case of the entire procedure of human-robots interaction. The aim of reliability in this context can be observed by examining the approach of the reliable performance of repetitive tasks, by robots. Reliability and flexibility are two core perspectives concerning the overall implications and significance of the broad idea of human-robots interaction. Error-free results from robots, ultimately, helped human beings to ensure the successful application of the entire assembly procedure (Hancock et al., 2011). High-quality requirements and non-ergonomic tasks, demand the adoption of rational working domains. This domain is possible through the practical idea of robotic functioning under the spectrum of human-robotic interactions.

**Weaknesses of Human-Robots Interactions**

The human-robots interface also involved some forms of weaknesses that require necessary attention. Identification of problematic domains of this process, is a necessary step to obtain desirable outcomes from the idea of human-robots interactions. The existing weaknesses in the case of human-robots interactions can be observed through both the domains of user-centered and robotics-centered features. The weaknesses of this discipline can be observed in the form of methodological perspectives. It is one complex situation that all the outcomes can never be compared directly referring to the application of different types of robots (Dautenhahn, 2007). One human-robots interaction experiment, does not apply to a multitude level of communication between human beings and robots. The result of one interaction applicable to the specific idea of consideration in the form of active collaboration between humans and robots.

 Another core weakness that appears in the case of human-robots interaction is that it involves the application of complex aspects that might be characterized as costly and time-consuming domains. The development of complex robots for human-robots interaction demands the use of a significant amount of various resources. Consideration of different resources, is an obligatory approach concerning the practical aspects of suitable research and related instruments. Inadequate form of funding, in the context of human-robots interaction, is one major challenge that prevails in the case of an entire scenario of active communication between human beings and robots (Murphy, 2004). Different forms of human weaknesses, also played a critical role to determine the suitable approach of human-robots interaction in the desired manner. The weakness in the form of human error can never be fully ignored, concerning the main approach of human-robots interactions. Any form of human negligence, eventually negatively affects the approach of communication between human beings and robots.

**Opportunities for Human-Robots Interactions**

The practical idea of human-robots interactions also actively concerning the attainment of different opportunities. The broad discipline of anthropomorphism, helps to timely and successfully recognize the potential opportunities of the practical spectrum of human-robot associations. Critical evaluation of human-tendency to meet the standards of technological advancement, is a mandatory domain to meet better forms of human-robots interactions, for the benefit of the entire universe (Arkin, Fujita, Takagi, & Hasegawa, 2003). The increasing number of manufacturing and service robots, ultimately, enhanced the chances of active communication between human beings and technological advancement in the form of operations of robots.

The major opportunity appeared in the form of the development of robots to increase the interaction level between humans and machines, to achieve desired outcomes. Implications of nonverbal and multi-model interaction interface, provide a great opportunity to increase the potential interaction between human beings and robots, as the main stakeholders. Critical sensing and perception also help to identify potential risks. Proper learning in the form of improved social interaction is another crucial factor of consideration to achieve maximum benefits from the main idea of human-robotic interactions. The higher form of social adaptation, ultimately made it easy for robots to decode all the information shared by human beings. Sensing human problems by robots is one of the critical opportunities to attain better outcomes from the broad idea of human-robots interactions (De Santis, Siciliano, De Luca, & Bicchi, 2008). This specific perspective is helpful for humanity to provide better services to individuals who require assistance from machines due to their inability to perform different tasks. Better functioning mechanisms, mainly in the form of affordable humanoid robots in a significant opportunity, can be successfully achieved through the practical idea of human-robots interactions.

**Threats of Human-Robots Interactions**

Exploration of potential threats of human-robots interaction is also an essential condition to meet the anticipated successful targets, of this specific approach. Safety analysis is a necessary measure to examine various threats related to the practical idea of human-robots associations. One of the core threat in the case of the increasing form of communication between human beings and robots is that it might increase risks for human development. It is one controversial and chronic concern that growing interaction between humans and robots can cause the replacement of human beings, in case of different organizational tasks. There is a need for offering balanced practical measures to effectively sustain the human being’s position as the central shareholder, in the scenario of technological development.

  It is argued that the increasing trend of human-robot interactions ultimately increases risk factors for humans. The main hazard in this manner can mainly be observed as the approach of moving part to enhance overall performance. Improper safety measures for robotic installation, can be immensely detrimental to the prospect of communication between human beings and robots. The overall safety is one prominent consideration that required during different phases of human-robotic interactions (Fong, Thorpe, & Baur, 2003). The development and application of necessary and immediate measures in this manner, is an integral step to propose better practical grounds for robotic operations.

**Financial Consideration of Human-Robots Interactions**

The financial consideration of the practical idea of human-robots interactions can also never be ignored to gain maximum benefits from this advance technological perspective. The economic implications of the procedure of human-robots interactions help to characterize the actual feasibility of this idea by examining different financial opportunities and hazards. It is vital to examine the economic suitability of using robots for different industrial development and social purposes. “Human-Like” capacities of robots involve a huge form of investment that requires necessary attention and proper planning.

           All the various forms of the procedure of human-robots interactions in the form of sensing, dexterity, memory, adaptability, and physical application eventually require some forms of financial investment. Different forms of advances, such as the prospect of artificial intelligence, are not possible without determining the economic estimate of the whole idea of robotic installments. It is established that the increasing trend of autonomy and human-robot interaction will soon achieve the perspective of new human-like tendencies. These growing capacities can be mainly identified in the forms of engaging economic agreements (Steinfeld et al., 2006). The growing idea of economic agreement in the scenario of human-robot interactions involves active exchange and proper consumption of different goods and services. This form of economic interaction greatly linked with the growing phenomenon of human-robot interactions.

           A practical prospect of a robot economy, is helpful to approach to evaluate financial consideration of human-robots interactions to achieve desired outcomes to technological development. The economic system in the form of a robot economy, embraced the idea of considering intelligent robots as an autonomous agent to successfully align with various human capacities. The active influence of human-robotic interaction can mainly be observed considering the economic forms of economic growth, employment level, and the desired facet of the income distribution. Financial aspects of the concept of human-robots interaction can be observed in two major forms that ultimately influence the employment level. The major financial implications of human-robots interactions appeared when robots start directly replacing humans from their job tasks. This practical facet of consideration characterized by the economic concept of displacement effect. The financial influence of the idea of human-robots interactions can also be observed in the productive economic form that is defined as the practical domain of productivity effect. This financial idea focuses to develop human-robotic interaction to enhance the overall demand of labor by offering new forms of industries and services sector. The development of new jobs is one cost-effective idea of a practical approach of human-robots interactions (Arkin et al., 2003). The growing intervention of robots in the industries to create more job tasks for workers can be characterized as one positive form of the growing trend of human-robots interaction.

           Industrial human-robot interactions required a huge investment to successfully design, process, and utilize the technological approach in the form of robots. Undoubtedly, the adoption of human-robot interactions is one costly approach that is associated with the consideration of different associated factors. The future of this paradigm is close related with the critical evaluation of economic patterns and feasibilities according to the specific needs of different industries and services sector. Additionally, there is a need for enhancing the approach of research to improve the standards of association and active communication between human beings and automated machines in the form of robots (Goodrich & Schultz, 2008). The objective of extensive research work can only achieve through the application of proper funding and ensure necessary investment in specific developmental sectors.

 **Social, Ethical, and Legal Concerns**

The growing involvement of robots in the lives of human beings also raised some serious concerns at social, ethical, and legal levels. A critical assessment of these aspects, is one essential measure to determine the actual suitability and effectiveness of the idea of robots-human interaction. This form of assessment is also vital to develop a particular code of conduct, to ensure interaction association between humans and robots, according to the standard. It is significant to understand that the perspective and involvement of autonomous machines can never be ignored. The best solution to enhance this interaction level is to ensure proper solutions to different social, ethical, and legal issues at both the social and governmental level.

           It is argued that new technologies, mainly in the form of robots, caused some serious social concerns that require necessary fixation. The social concerns are relevant to the significant application of the idea of new technology mainly in the forms of human-robots interactions. The inadequacy of the social environment to accept the new idea of an association between human beings and robots is one central and social concern that requires the necessary attention. This sort of concern can be successfully addressed by enhancing the approach of information technology literacy, for human beings. It is a central responsibility of the stakeholders to the developed social environment according to changing requirements of technological advancement. The central idea of enhancing the approach of human-robot interactions is to ensure the successful application of technology according to the social, ethical, and legal standards.

           Exploration of ethical concerns in case of human-robots interactions in also mandatory to ensure active consideration of ethical grounds. The domain of ethical consideration is mainly identified in the form of hominoid robots. The major ethical concerns are revealed as the issues relevant to a threat to privacy, hazards for human dignity, and the phenomenon of trustworthiness. All these ethical domains are under serious risks that require actively focus to apprehend the idea of human-robot interactions in a successful manner. It is important for the stakeholders of human-robotic interactions to successfully ensures the privacy of all the individuals. Furthermore, the dignity and trust level of human beings should also never be ignored to use robots as assistants for human beings to successfully execute their job tasks.

           The legal domain is also closely related to the successful application of the process of human-robot association. It is mandatory to ensure communication between human beings and machines according to the legal frame of action. When organizations design, process, and assimilate the idea of robots for different tasks than it needs to be successfully aligned with the legal rights of human beings as workers. The legal concerns are mainly recognized in the form of any form of injury or damage due to improper application of robots. Concerns in case of data privacy is another issue associated with the broad form of the legal spectrum. It is critical for the industrial and service entities to ensure the successful development and implication of legal standards to create an essential balance between job tasks performs by human beings and robots. Liability issues are another critical aspect concerning the idea of legal concern in case of systematic procedure of association or active communication between human beings and robots.

**Conclusion**

In this era of technology, new inventions have been done such as human-like robots, which have replaced humans. Nowadays many activities are done with the help of robots and they are developed in such a way that they tend to understand the instructions being computed in their programming. There are some strengths and weaknesses based on SWOT analysis. It is an advantage that robots have made our work easier and they work for us according to our desires and demands. They do not feel exhausted as humans do, however, they need electrical energy to make them work. The humans-like robot has made organizational works easier, because they do not tend to commit mistakes and errors like humans. They work effectively to achieve organizational targets and in a short period.

In contrast, there are some drawbacks to these innovative technologies such as, humans are replaced by them, leaving humans hopeless for getting any employment opportunity. Human interactions have decreased due to robots, which complete tasks without asking other humans. This innovation has led to financial constraints in humans and they are not being able to earn for themselves. These humans like robots have caused some ethical and moral issues, so it is important to carry some assessments to avoid issues of communication gaps due to which conflicts between people have increased. If these assessments are carried on the governmental level to limit these innovations, then there will be a normal life; people will be able to earn and they will be interacting with each other without any communication hindrances.

**References**

Arkin, R. C., Fujita, M., Takagi, T., & Hasegawa, R. (2003). An ethological and emotional basis for human–robot interaction. *Robotics and Autonomous Systems*, *42*(3–4), 191–201.

Dautenhahn, K. (2007). Socially intelligent robots: Dimensions of human–robot interaction. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *362*(1480), 679–704.

De Santis, A., Siciliano, B., De Luca, A., & Bicchi, A. (2008). An atlas of physical human–robot interaction. *Mechanism and Machine Theory*, *43*(3), 253–270.

Fong, T., Thorpe, C., & Baur, C. (2003). Collaboration, dialogue, human-robot interaction. In *Robotics Research* (pp. 255–266). Springer.

Goodrich, M. A., & Schultz, A. C. (2008). Human–robot interaction: A survey. *Foundations and Trends® in Human–Computer Interaction*, *1*(3), 203–275.

Hancock, P. A., Billings, D. R., Schaefer, K. E., Chen, J. Y., De Visser, E. J., & Parasuraman, R. (2011). A meta-analysis of factors affecting trust in human-robot interaction. *Human Factors*, *53*(5), 517–527.

Murphy, R. R. (2004). Human-robot interaction in rescue robotics. *IEEE Transactions on Systems, Man, and Cybernetics, Part C (Applications and Reviews)*, *34*(2), 138–153.

Steinfeld, A., Fong, T., Kaber, D., Lewis, M., Scholtz, J., Schultz, A., & Goodrich, M. (2006). Common metrics for human-robot interaction. *Proceedings of the 1st ACM SIGCHI/SIGART Conference on Human-Robot Interaction*, 33–40. ACM.

Thrun, S. (2004). Toward a framework for human-robot interaction. *Human-Computer Interaction*, *19*(1), 9–24.

Yanco, H. A., & Drury, J. (2004). Classifying human-robot interaction: An updated taxonomy. *2004 IEEE International Conference on Systems, Man and Cybernetics (IEEE Cat. No. 04CH37583)*, *3*, 2841–2846. IEEE.