



Role of Soft Robots in the Industries

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Abstract

Soft robots are gaining importance continuously in various sectors of life including various industries. The pressing economy of the world and the price rising of almost all commodities are compelling the technocrats to start low-price industrial production. In this direction, soft robots may be used in various industries for low-cost production. This article reviews the applications of soft robots in various industries. Efforts are made to discuss the future market in industrial applications. Besides, the challenges and future perspectives have also been discussed. This article may be useful to students, academicians, researchers, and industrial persons.

Keywords: Soft robots; Industrial applications; Market; Future challenges; Perspective

Introduction

Soft robots resemble living organisms in terms of different motions and actions. Soft robotics is a growing field to make flexible devices for many purposes like healthcare, space exploration, food, geography, logistics, rehabilitation defense, food & beverage, houseware, etc. Soft robots are made of amenable materials with lightweight and versatile in function. Soft robots have high elasticity, deformability, and energy-sorbing features, leading to rapid restoration of their bodies. Soft robots have high potential in various fields of research and industrial applications [1-3]. Soft robotic investigation is essential to be used in various industrial applications; especially in places where human beings cannot do it properly and efficiently. The use of soft robots in industries is required to complete automation for inexpensive commodities and to increase the economy of the world. During my training and knowledge, I understood that soft robots are the prospective tools to carry out various tasks in different industries. This article summarizes the various probable industrial applications of soft robots in the future. Efforts are made to discuss the challenges and future perspectives. This article will be useful to students, academicians, researchers, and industrial persons to carry out

more advanced research in soft robotics to make their applications useful in different industries.

Industrial Applications

Industrial automation is rising rapidly for many years. This is because of the pressing demand for low price commodities. In this direction, the use of robots has been found effective [4]. The other places of requirement are warehouses, supermarkets, and other management places. The soft robots demand in industries is increasing due to the need for high-quality production at low prices. The use of soft robots reduces human errors and escalates the potency of production. The soft robots used in the industries are called collaborative robots or Cobots mimicking human' industries.

The most important sector of soft robots is health care where they may be used in surgery, pain relieving machines, artificial muscles, etc. [5]. They may also be very useful in micro-surgery; especially inside the body. The tiny soft robots may be used as drug carriers in targeted therapy; particularly in cancer diagnosis and treatment. The safe interaction of soft robots with animal bodies makes them ideal tools for surgery and other health care

requirements. The damaged muscles and some body parts may be repaired/replace by soft robots (prosthetic robots). Many people are losing their lives to heart failure and soft robots may be used to save their lives by helping to pump hearts or making artificial hearts. The second important sector of soft robot demand is the space aviation and space research industries. The reason is that we need more advanced air carriers for a journey with the economy. Besides, the unpredictable space environment also needs smart robots that can adjust their functions rapidly as per the change of the environment. The soft robotic examinations of the aircraft (pre-flight checks) can decrease the time in maintenance and repair of aircraft. Boeing is planning to manufacture aircraft flying automatically by use of soft robots. It is also envisaged that soft robots may be used in other airport ground services i.e., passenger interface, housework and law implementation. KLM has tested one soft robot to guide passengers at the airport.

There is a big demand for automation via robots in the food and agriculture industries as well [6]. Soft robots may be useful in agriculture and food industries for large-scale crop production at low prices and management; crops and packing technology. Generally, the farmers use toxic pesticides in the crop and, sometimes, cancer appears in the consumers. For this purpose, soft robots may be highly useful. Automatic agricultural appliances may be highly useful as there is a huge paucity of labor in the agriculture sector due to harsh conditions. Sometimes, farmers are supposed to work at odd hours of the night and under such situations, soft robots may be assets. The agricultural sector produces a huge amount of food materials, which need large labor for their packing and other management. Soft robots may fulfill this task easily. The energy industry needs soft robots urgently because of the harsh working conditions. The future is of atomic and nuclear energy where the workers are always on nuclear radiation exposure. Under such a situation, soft robots may be ideal candidates to serve the purpose. Soft robots can be deployed around the clock to generate atomic and nuclear energy. The defense sector may have another useful demand for soft robots. In some situations, the soldiers creep for defense and this task may be carried out for the creeping soft robots. Besides, heavy equipment operations may be carried out efficiently in dangerous conditions. Other useful applications of soft robots may include battle damage control, aerial refueling, electronic warfare, laying mines, and others.

The automobile industry may be the major user of soft robots because many contemporary robots are being used in this industry [7]. These are rigid robots and some tasks cannot be performed easily, which need soft robots. Soft robots may be highly useful to assemble various parts during manufacturing. The other applications of soft robots in the automobile industry may be moving materials, parts inspection, spraying paint, etc. A soft robot is being used in Mercedes Vision AVTR for driver help in communication with the environment. Soft robots may be useful in fully autonomous cars, trains, etc. The other industrial applications of soft robots may be highly useful in the entertainment, edutainment [8], and toy industries due to their controlled locomotion. Soft robots may perform various activities, and fascinatingly teach our

kids without getting tired. Besides, these may be used to make a variety of attractive toys for making our kids happy. Soft robots may be highly useful in industries making explosive items. Besides, they may be highly useful in arc welding, spot welding, machine tending, painting, picking, mechanical cutting, gluing, adhesion, etc.

Challenges and Future Perspective

Verily, soft robots may be highly useful in various industries but there are numerous challenges. These include operative working efficacy design, autonomy, fabrication, exact actuation, and incessant power generation. The soft robot's design is very crucial as being used in a varied industrial environment. To solve this issue we need a variety of advanced and smart materials [9] along with sophisticated simulation to get the perfect design and body as per the required tasks. The morphological computation (embodiment) of artificial intelligence may be useful to achieve the task. The world is under the pressure of the economy and looking at low prices of commodities. The production price may be lower by automatization of all the industries through soft robots. Consequently, there is a persistent need to develop self-powered, soft assistive, and autonomous robots in the future. Therefore, the future of soft robots in industrial applications is pretty bright.

Future Market

The future market of soft robots is quite bright and expected to rise by 37% compound annual growth rate from 2019 to 2024 [10]. Every day, researchers and technocrats are working to develop more advanced soft robots as per industrial requirements. Consequently, the probability of soft robots market growth is high. Soft robots will be required by many industries as discussed above along with other sectors like Walmart, Amazon, Costco, etc. for taking care of their warehouses. In brief, the demand for soft robots will upsurge in every segment of life; enhancement in their market. Therefore, soft robots are being developed by many companies such as Empire Robotics, Inc., USA, Ekso Bionics Holdings Inc., USA, Soft Robotics, Inc., USA, Intelligent Soft Robotics Market include Cyberdyne Inc., Japan, FANUC Corporation, Japan, Franka Emika GmbH, Germany, GLI Technology Ltd., China, and F & P Personal Robotics, Switzerland. However, the production of soft robots is not fully industrialized and is in progress. In a nutshell, the soft robots' future is quite bright.

Conclusion

Soft robots are gaining importance in various industrial applications to make production at a low cost. In this way, the use of soft robots may be useful to grow the economy of the world. The most important industries for soft robots demand are health care, aviation, space exploration, agriculture, food, logistics, rehabilitation defense, food & beverage, and houseware. There is a great demand to develop soft robots and some companies are trying to make effective soft robots. The development of soft robots is not fully developed for a varied variety of functions. It means we need to work hard to make the complete robots. The future of robots in industries is quite bright and certainly, the production cost of many commodities will go down in the future; leading to a strong world economy.

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Conflict of Interest

No Conflict of interest.

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