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IMPLEMENTATION OF ROBOTICS AND ARTIFICIAL INTELLIGENCE IN THE PHARMACEUTICAL SECTOR

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ABSTRACT: The rapid development of artificial intelligence (AI) has far-reaching consequences for the global economy. Computers are helping with human input, decision-making, and data provision in medicine more than ever before. AI, algorithms, robotics, and big data are all used in today's healthcare sector and the medical profession to derive inferences for monitoring large-scale medical trends and detecting and measuring individual risks and chances based on data-driven estimations. Healthcare is a knowledge-intensive industry that relies heavily on data and analytics to advance treatments and procedures. There has been a significant expansion in the types of medical data gathered in recent years. This includes clinical, genetic, behavioural and environmental information. Large volumes of data from various sources are generated daily by healthcare providers, biomedical researchers, and patients. Technology advancements, such as AI, allow for the analysis of human thought processes. The pharmaceutical business saw significant transformation as a result of the application of machine learning, AI, and automation processes. Various types of analysis have contributed to a general decline in death rates. The use of AI techniques aids in diagnosing the most serious illnesses. To properly diagnose and treat a patient, it is essential to first identify any potential genetic disputes. Technological advancements have made it easier for pharmaceutical companies to detect dosage mistakes. Machine learning relies on monetary analysis, regular spectral analysis and the feature attraction process. The creation of an intelligent computer program is crucial for modelling mechanical systems. In this review, we have glanced at how technology plays a part in the pharmaceutical industry and at the potential outcomes that robotics and AI could have.

INTRODUCTION: Robotic systems with artificial intelligence (AI) can learn, make decisions, and solve problems in a manner comparable to that of a person, but they are not yet capable of making decisions on their own [1]. Artificial intelligence (AI) is the study of machines that are capable of reasoning, planning, learning, and perceiving.

Computer-like robots can be programmed to imitate even the most basic aspects of human intelligence using a variety of algorithms. The goal of AI systems is to construct systems that can solve complicated issues in a manner similar to human reasoning [2]. Material pieces, tools, and other specialized equipment can be moved through a

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range of pre-programmed motions using a multifunctional manipulator. It's time for a fourth industrial revolution that will change everything from how we work and live to even what it means to be human. It's a group of technologies, including Artificial Intelligence, 3D printing, Robotics, and big Data, working together to transform almost every industry, including the pharmaceutical industry [3]. These technologies include artificial intelligence, 3D printing, Robotics, Big Data, and some things on the sort of life sciences fronts, such as genetics and medical imaging. AI or Robots will replace semi-automatic machines, automation machines, or human labour in the pharmaceutical sector [4].

In the medical field, every fourth person will be older than 65 by 2050. We cannot expect the NHS to handle the expected rise in chronic sickness. Reconfiguring health and local government services to focus more on community care and effective technology use is necessary to tackle this challenge. Robotics is a promising new technology with Robotic Process Automation (RPA), the boring and repetitive duties of daily life will be taken care of by robots. It provides a new field of study for researchers, and a wide range of studies are taking place in this area. Unlike Robotics, this is an entirely new technology. A relatively new and rapidly expanding area of robotics is RPA. In the healthcare and pharmaceutical industries, there is a lot of data, or "medical big data," that needs to be analysed and evaluated [5].

New drug development, drug formulation, drug delivery techniques, or in-patient and out-patient operations generate a great amount of data in the healthcare and pharmaceutical industries. Data science and RPA, on the other hand, offer useful methods for dealing with massive amounts of data [6]. Among the topics covered in this article are RPA's key features and its use in the healthcare and pharmaceutical industries. An RPA system can cut costs and delivery times, enhance the quality, speed, and operational efficiency of corporate processes and provide a long-term solution. New insights can be gained using Machine Learning (ML) technologies in the healthcare industry [7]. The author also proposes an RPA/ML framework to ensure standardization and quality control of Bhasma, an end product of the ancient Ayurvedic Indian medical system. Self-improvement and life enhancement have always been at the forefront of human endeavours. During the Stone Age, man discovered how to carve stone, and eventually, he was able to create metal. As a result of its constant evolution and refusal to settle for the status quo, humanity has become a paradigm for the next generation of innovators. It was in Japan in 1969 that the "Mechatronics" science was first developed; mechanical engineering closely interacts with electronics and computers in engineering and process.

Mechanical design and analysis, robotic systems, image processing, control engineering, artificial neural networks, and virtual reality with artificial intelligence are some of the topics covered by the science of mechatronics [8]. Mechatronics science begins with robots, which are electromechanical devices. Since the beginning of recorded history, humans have wished to give life to manmade systems. Regarding robots, the first thing that springs to mind for most people's mental images are machines with human features. Contrary to popular belief, most robots in use today are industrial robots utilized in quick, repeatable, and reliable manufacturing processes. The industry has the same technological advancement in a continually evolving and changing globe as the rest of the world [9]. With the advancement of science and technology, people began to choose mental activity over physical exhaustion.

Artificial Intelligence (AI) and Robotics: It is estimated that the pharmaceutical industry invests billions of dollars each year in developing novel chemicals and treatments. Increasingly, pharmaceutical corporations rely on big data to design clinical trials that are less likely to fail, reducing the overall cost of R&D [10]. Artificial intelligence (AI) in Healthcare will help with various tasks, including managing medical records and other data, automating routine tasks, designing treatment plans, utilizing digital consultations and virtual nurses, administering medications, discovering new drugs, and conducting system analyses. The term "artificial intelligence" refers to software that is capable of reasoning, planning, learning, and seeing on its own. To get over the drawbacks of symbolic AI, there is a branch of artificial intelligence known as "symbolic AI" sub-

symbolic methods like neural networks, fuzzy systems, evolutionary computation, and other computational models, known as "computational intelligence," began to gain prominence, becoming an area of AI **Fig. 1** [11].

FIG. 1: AI AND ROBOTIC

Robots in Healthcare are being Programmed with Artificial Intelligence: Robotic pharmacies use robots and automation to do all monotonous operations, from completing patient prescriptions to sorting pharmaceuticals and delivering them to correct patients using a 'coded bar' recognition system.

Medical Robots: During minimally invasive procedures, surgeons can move surgical instruments or catheters with more dexterity attributable to the use of medical robots [12]. Surgeons can move surgical tools with joysticks or telemanipulators during robotic procedures, just like they would in a video game.

The TUG Robot: Pittsburgh-based Aethon's TUG is an autonomous mobility robot designed exclusively for hospital use. Carry laundry and trash as well as hefty loads such as prescriptions and specimens. Through Wi-Fi, it communicates with elevators, fire alarms and automatic doors and uses a built-in map and sensors to navigate the hospital halls [13].

Challenges of Robots:

Expenditure: The initial investment in robotics, especially for new robotic equipment, is a major factor in limiting the purchases of business owners. To run a more efficient business, the whole cost of all expenditures must be taken into account. The keeping of a ledger and other records is essential to the operation of any business [14].

Jeopardy and Dreads: As far as we know, there is no evidence that present robots can harm humankind. Many people's fears and anxieties have been well-expressed in literature and movies. One big problem with robots is that their ability to act outstrips ours and they may have morality or enthusiasm that surpasses that of humans, making them more dangerous [15].

Proficiency: The Company's employees must be given programming training before engaging with the new robotic equipment. When the new robots arrived, they could handle them effortlessly (**Fig. 2** [16].

FIG. 2: VARIOUS CHALLENGES OF ROBOTICS

Return on Investment (ROI): Pharmaceutical departments utilizing robotic assistance isn't certain to yield positive results. There must be good planning for better results, and without planning, companies have a hard time reaching their goals [17].

Safety: Robots have the ability to work quicker and more accurately than people, and they can safeguard workers from hazardous situations, but they can also cause safety issues. These new hazards necessitate thoughtful consideration [18].

Laws of Robotics: ISSAC ASIMOV, an American writer, developed a set of laws for robots. In 1940, he coined the term "robotics" and gave the three laws of robotics that are shown in **Fig. 3.** These laws govern the creation of all robots. As technology has progressed, robots have evolved from simple mechanical machines to ones that incorporate computer chips and microprocessors. Every industry, from the pharmaceutical industry to medical care to retail, benefits greatly from the use of robots [19]. The robot's programs are pre-installed and can be programmed to carry out certain tasks. The development of robots necessitates the use of artificial intelligence, which is capable of emulating human cognition. Many different types of industrial robots exist, including Cartesian, SCARA, Articulated and Parallel robots. Training and programming are vital for each and every robot to execute the best duty and it does not hurt humans. There are numerous sorts of robots that do not require special training [20].

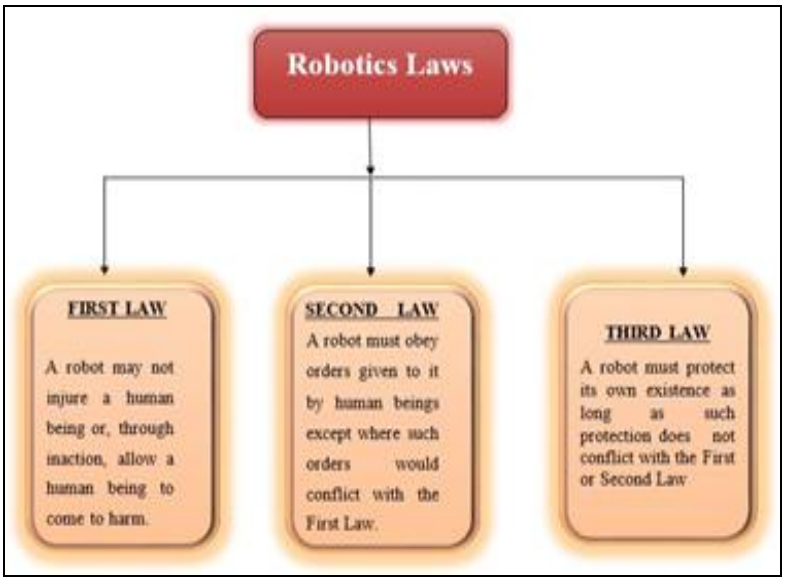

FIG. 3: ROBOTICS LAW

Essential/Key Characteristics & Components of Robots: To be able to mimic human thought, robots must possess the following features [21]. The following is a list of some of the most important qualities of robots is discussed below:

Sensing: In order for a robot to be able to emulate humans, it would need an excellent sense of direction. Sensors such as vision sensors, force sensors, proximity sensors and tilt sensors must be included in the robots [22].

Movement: A robot that can go in any direction it wants, depending on what the user wants. Depending on how the programme is written, a robot can travel in any one of three directions: X, Y, or Z, depending on how the program is written [23].

Energy: The need for energy to perform tasks necessitates the use of electrical, solar, or battery-powered robots. The energy requirements of the robots were determined by the type of job they were to undertake [24].

Intelligence: Smarts are an essential ingredient for success in any endeavour. A well-trained robot will be able to complete the task quickly and accurately. The robot's intelligence should be built into its design. It runs on its own when it has been programmed **Fig. 4** & **5** [25].

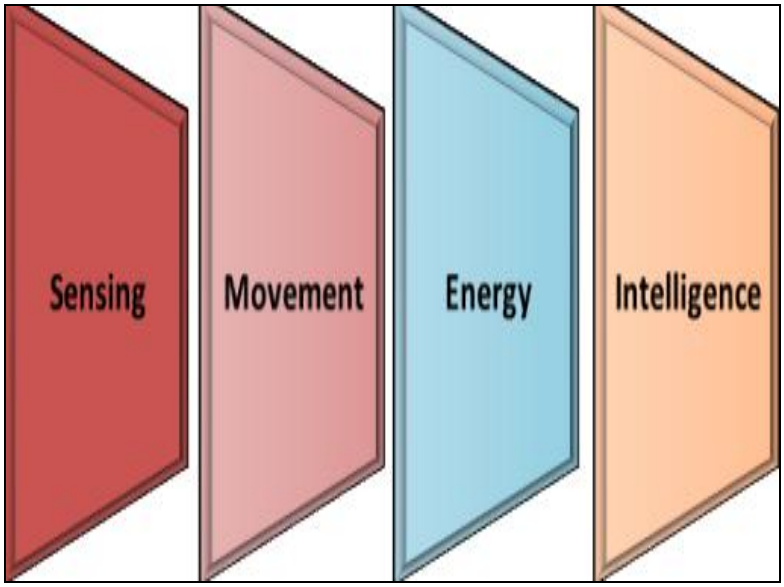

FIG. 4: VARIOUS CHARACTERISTICS OF ROBOTICS

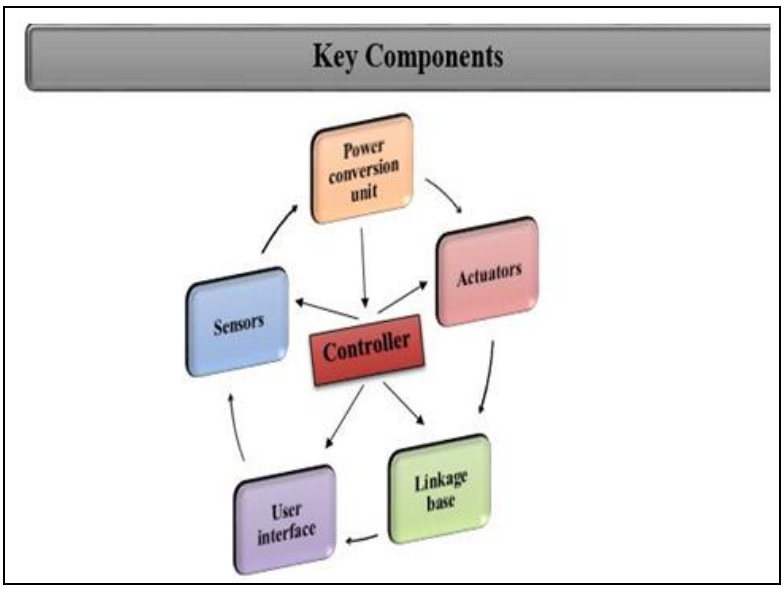

FIG. 5: KEY COMPONENTS OF ROBOTS

Robotic Pharmacies- The Latest Innovation in Medicine Dispensing: Automation and robotics profoundly impacted a wide range of industries. Health and medical services are not an exception to the great growth and recharging potential of healthcare services. Dispensing medical supplies has always been an element of the job description for healthcare service providers.

At this stage, the robotic pharmacy offers revolutionary advantages. Robotic pharmacies use robots and automation to execute all monotonous operations, from writing patient prescriptions to organizing the meds and delivering the same to correct patients via a recognition 'coded bar' [26].

A Footstep Forward of Traditional Medical Dispensing: The conventional pharmaceutical techniques of making dosages and organizing medicines according to the needs of patients are all part of the process of manually categorizing medicines.

A lot of time is spent on these responsibilities by pharmacists. Robots and automation are increasingly used in medical dispensing to do tasks such as mixing, classifying, and packaging drugs with minimal human participation [27]. The following are some of the advantages:

Improved Performance: There are no human errors when a robot pharmacist fills and organizes vast quantities of drugs, unlike a human pharmacist. In addition to increasing operational efficiency, this frees up pharmacists' time to perform more value-added tasks [28].

Efficacy in the Pharmaceutical Manufacturing Process: Manual pharmacy operations have the drawback of causing pharmacists to prescribe a dose and fill out patient information on prescriptions at the demand of their patients. It's possible that this will lead to major health problems and issues with regulatory compliance [29].

Security: Pharmaceuticals are safely stored in dispensing devices in a robotic pharmacy. In order to operate this equipment, only those who have the proper access control can do so. The risk of medication theft or error is reduced thanks to the high level of protection. Software in the system keeps track of every dispensation, allowing for accurate tracking and shooting [30].

Patients' 'Waiting Time' will be reduced: Compared to manual processes, robotic medicine dispensing equipment can fill thousands of prescriptions every hour. As a result, patients will have a more positive experience, which will lead to a decrease in wait times [31].

A Safe and Germ-free Place to Work: Many of the illnesses are caused by infections caused by microbial exposure and medication mis-management. In a sterile setting, a robot pharmacy can handle this problem [32].

How the Pharmaceutical Industry has been Affected by Robotics: There were a lot of hard and repetitive tasks that needed to be done by robots in the early 1970s, such as welding and handling in automobile assembly lines.

In the automobile industry, for example, the first ABB robot was developed in 1974. Since then, more than 150000 have been installed worldwide, with the pharmaceutical industry accounting for the majority of those [33].

Many of these early clinical robots were only programmed liquid handlers that served as mechanical arms for high-throughput screening (HTS) devices. Robotics has not been able to be integrated into the manufacturing and packaging processes.

Robot's technological character was unquestionably a contributing factor. Metal production machinery, which appeared to be filled with oil, didn't seem like a good fit for pharmaceuticals [34].

Robotics Implementations Pose the Most Risk: Robotic automation deployment, like conventional application development and delivery, is not a stand-alone installation.

The way robot’s interface with these applications and the process is strongly reliant on the method, implementation and technological infrastructure. Flow, as a result, the system's environment influences the governance model, resulting in increased complexity **Fig. 6** [35].

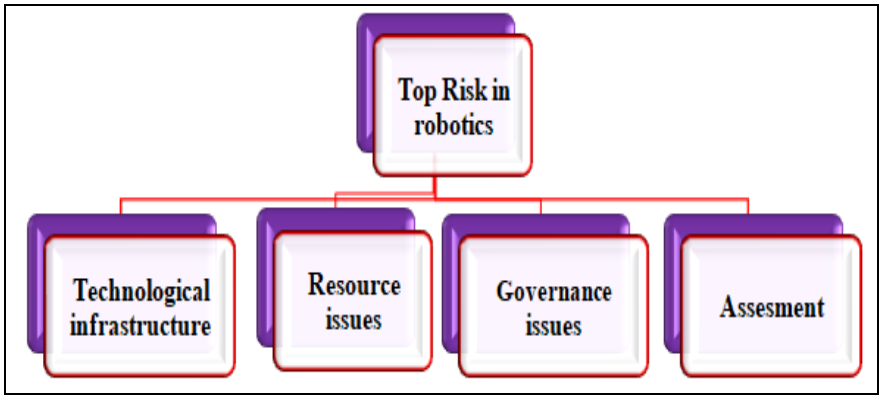

FIG. 6: TOP RISK IN ROBOTICS

Infrastructural Technology: Virtual desktops, Citrix, and VMs are all part of the technological infrastructure, but only some automation devices can use them. As a result, deciding on the best infrastructure configuration is a difficult task. Energy will be wasted if an automation tool is incompatible with the project. Robotics application deployments are another environmental hazard.

Unanticipated and unexpected circumstances can halt a robot's progress. Few systems offer dynamic controls, which can change and affect robots at certain intervals. In financial environments, data transparency is a major issue. Disparities in the availability of data and the technical environment are the primary problem with the technological infrastructure, as are application problems, application dynamism and non-compatibility with automation tools [36].

Resource Issues: The automation of a process requires various parties, for example, one team finalizes the specs, while another conducts testing, and the end-users are altogether different. That leads to problems of mismatching and modifying standards. It's also encouraged to hire a particular team to send and test automation specifications in all stages. It's also encouraged to hire a particular team to send and test automation specifications in all stages of projects [37].

Governance Issues: Attrition leads to a lack of consistency, affecting the automation project's efficiency and timely performance. Given resource availability, some clients prefer automation projects to operate on projects of staff increase where they recruit personnel for the moments of time. The problem here is quality output lack of aid from senior technical support and projects managements normally; such projects encounter challenges after going live and are unstable [38].

Risks Assessments: Automation aims to achieve financial benefits through fewer human resources or streamlined processes. A key difficulty is a gap between the automation efforts and the benefits received. For example, an operation that is handled at a lower level or has very few people working on it does not yield anticipated benefits or receive ROI from automation. In other circumstances, procedures appointed for automated operations have constraints such as shorter cut-off times, the requirement for manual judgment, or overestimated volumes, which make automation hard and occasionally impossible. Overall, the largest risk factors in robotic adoption are infrastructure (64 percent), followed by assessment (19 percent), governance (12 percent) and, resources (5 percent) **Fig. 7** [39].

When implementing automation projects, an enterprise should ensure that the same technologies are used in the development, testing, and production environments. Any modifications to the application will be announced ahead of time, and the automation team will effectively study all changes to the underlying applications. The development team will follow the same process when it comes to user acceptance testing (UAT) and approving off on automation. After UAT has been completed to a higher standard, the team will deploy the underlying program modifications and the modified robot script into production. Organizations must follow the same strategy even when upgrading automation solutions to newer versions. Even when upgrading automation solutions to newer versions, organizations must follow the same strategy [40].

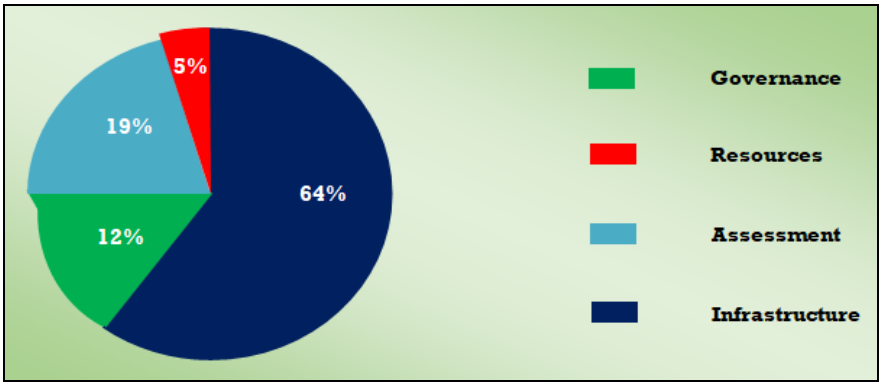

FIG. 7: MAJOR RISK CONTRIBUTORS IN ROBOTIC IMPLEMENTATION

Preventative Measures: All resources must be supported by product development as part of the paradigm for increasing employee numbers. Attrition and untrained resources can occur in a variety of ways. Depending on the project's size and scope, resources will be allocated. The support team or its successors will continue to provide these services until the mechanism is fully stable and they are given proper hands-off [41].

Mitigation of Governance Risk: Business analysts, developers, and senior executives meet regularly to assess the automation project's progress and identify issues and appropriate approaches to ensure proper monitoring and reporting. To minimize the risk of governance, a well-organized team led by an effective leader who communicates only with the team's various stakeholders is a primary prerequisite. Working with other members of the team to assess the project's potential impacts and hazards reduces the likelihood of project failure [42].

Assessment of Risk Mitigation: The identification of appropriate processes suited for automation appears to be the key to minimizing hazards. In the PR automation evaluation phase, it will be evident what human efforts are necessary or the experiment's duration, SLA, turnaround time, *etc*., and SMEs should evaluate this during the process. For a successful start, there must be a clearly defined and observed evaluation of the process [43].

Benefits of Robots:

What's the Point of Robots? Findings from a Survey on the Use and Impact of Social Robots in Autism Therapy: Children with cognitive, emotional, and communicative disabilities have been tested to see if robots have been helpful. It was determined that the exact goal behaviors that should be evoked from a child while in treatment might be learned from child robot experiences. Such activities have been thoroughly researched in terms of a child's development.

Robots in the Study of Autism: There is a list of robots tested in this study listed in **Table 1**. Children with autism around the world benefit from robot therapy with varying degrees of success. Each has its own unique style, features, and interaction methods. Every treatment is designed to elicit one or more of the children being treated with the most typical behaviours [44].

TABLE 1: COMPILATION OF ROBOTS EMPLOYED IN AUTISM THERAPY FOR CHILDREN [45]

Robot	Types	Features
Bobus	Non-anthropomorphic	The robot can sense a child's presence, Play music and conduct simple movements in close proximity to the infan, Light-emitting diodes (LEDs) around the neck
CHARLIE (child-centered adaptive robot for learning in an interactive Environment)	Anthropomorphic	The robot has two braces and a mouth. Facial recognition camera and manual camera. Low cost and simple Durable and stable hardware.
CPAC	Non-anthropomorphic	Has a sturdy and flexible neck, arms and LED eyes with interchangeable pieces, Can rotate on itself, Could dance with a button click
Diskcat	Non-anthropomorphic	Catlike outer fur, Whiskers made of resistive bend sensors. Can play games like "Simon says" LEDs for aesthetic appeal in place of the eyes and at the

		back
HOAP-2	Anthropomorphic	50 cm in height. Metallic in construction 25, degrees of freedom: open / close hands, pan-tilt head, Gaze-tracking cameras
Infanoid	Anthropomorphic	Upper torso robot, Height of a 4-year-old boy Capable of guiding the eyes and face, Lip and eyebrow facial movements Hand and body motions
FACE (Facial Automation for Conveying Emotions)	Anthropomorphic	Female android Skin-like silicone rubber mask Motors push artificial skin on the mask Face and eye tracking *via* camera

Foreseeing the Future: Two major conclusions can be drawn from this development: If robots have not yet been utilized, they will be. It doesn't matter what industry you operate in; if there is a means to apply robots in your organization, it will likely reach eventually; whether or not it is liked. Our rivals may already be utilizing robots. In the event that they aren't, robots could give humanity a small advantage. If you want to keep up with the latest developments in robotic automation, you'll want to keep an eye out for these next trends [46].

Internet of Things (IOT) Implementation in Manufacturing: To acquire data previously unavailable to manufacturers, robots will increasingly place sensors at the edge of production. New levels of yield and productivity are on the horizon due to this trend, which is presently in motion [47].

Industrial the Most Pressing Issue today is Cyber Security: Increased cyber security threats are a result of robots being more closely linked to the central systems that collect data. To ensure safe and reliable production, manufacturers must fix process flaws and invest extensively in cyber security [48].

Analysis of Massive Data Sets (A Competitive Differentiator): The workshop floor is growing increasingly reliant on robots as a source of information. Even after all this time, gathering data is still just a piece of the jigsaw. The creators must implement systems to gather and analyze all of this data before they can take any action [49].

Implementation of Exposed Automation Architectures Is Underway: The demand for open automation designs grows as robotic automation becomes more widely accepted. Major industry players will develop standards and open documentation in collaboration with industry groups to make robotic addition easier and improve product compatibility [50].

Practical Solutions will Invade Physical Processes: Industrial robots will include cybernetics in their design. The cybernetic representation of robotic systems for proof-of-concept and offline programming is a currently increasing application. The use of collaborative robots is only going to increase in the future. Collaborative robots can work safely with humans and are frequently significantly less expensive than industrial matching parts. Manufacturers with rigorous ROI (return on investment) standards will begin to use collaborative robots as they become more proficient in challenging industrial environments. Robotic automation has been a game-changer in the industrial sector, but it is still expected to overhaul the industry in the next several years [51].

Demand is Rising: Operators in all industries will be forced to automate due to an aging population and labour limits. There is already a lot of strain on today's workforce, and this trend is just going to increase the need for innovative ways to fill the labour shortage [52].

Improvement in Quality and Output: There will be new, more efficient, and less expensive ways of doing things. Technology advancements should lead to a compliance assistance dispensing machine that can generate 60-70 trays per hour in five years [53].

Hub and Spoke: It's possible that a new law allowing third-party dispensing might be passed, paving the way for "dispensing groups" of a few dozen independent shops [54].

Integration: Pharmacy services will continue to be delivered online and automated systems and equipment will play a key role in the efficient delivery of these new models of healthcare [55].

Competition: As today's innovators continue to find success, other service providers will arise to

fill the need. Unless officials can be persuaded of the benefits of face-to-face patient engagement, global giants may look for ways to influence their infrastructure in order to meet patient wants and capture a large market share. Unless officials can be persuaded of the benefits of face-to-face patient engagement, global giants may look for ways to influence their infrastructure in order to meet patient wants and capture a large market share [56].

Globalization: In contrast to Europe and the United States, BRICS countries will significantly impact the development of new machinery, software and systems [57].

Some Generally Cast-off Robots in the Pharmaceutical Industry:

The KUKA KR 1000 Titan: A six-axis robot with open kinematics, the KUKA KR 1000 titan, is one of the most powerful heavy-load robots on the market. The body of the KUKA KR 1000 titan is constructed from Chrysler jeep components. The lifting capacity is 1000kg and it can carry loads up to 6 meters in length. Some heavy loads include stone, glass, steel beams, components for ships and planes (including marble blocks), engine blocks, *etc*. All of them are huge loads, but the KR Titan is up to the challenge **Fig. 8**. The KUKKA KR 1000 titan is both tiny and affordable: The main advantages of this robot are that it takes up less room and is less expensive, as well as that it has a higher output and is of a higher quality. When it comes to payload capacity, KUKKA is known as the world's first robot that can carry 1000 kg [58].

FIG. 8: KUKA KR 1000 TITAN

Food/Pharmaceutical Handling System with M-430iA Robot Arms and Visual Tracking, FANUC Ltd: For food and pharmaceutical systems, the M-430iA Robot has a payload capability of 2 to 4 kg. The M-430iA has a wide range of uses and is completely contaminant-free. The M-430iA is an intelligent robot primarily intended to prevent pharmaceutical product contamination, such as sterile product contamination by human operators. The M-430iA robotics includes a visual tracking system and multi-axis robot arms, each of which can pick up 120 items per minute as they travel on a conveyer belt **Fig. 9**. For 24 hours a day, the M-430iA multi-axis robotic arm can work efficiently. The benefits of the M-430iA multi-axis robot arm have been shown to be numerous, and it has been shown to reduce manufacturing costs and improve quality. M-430iA helps to avoid contamination; the M-430iA is USDA-approved and can be used to create unpackaged food, beverages, medical equipment, and many other items [59].

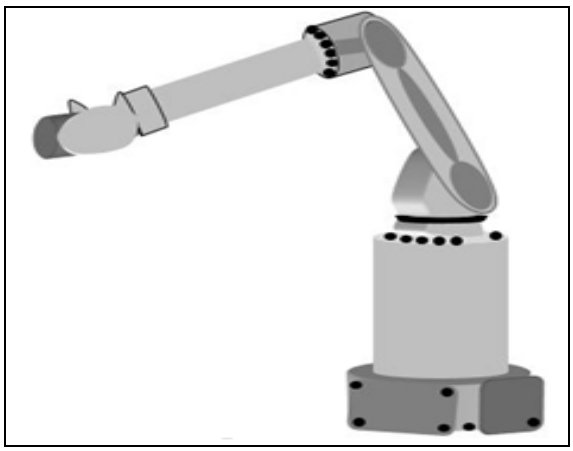

FIG. 9: M430I ROBOT

M-430iA Robots: The M-430i A is a 2 to 4 kg payload handling robot designed specifically for food or pharmaceutical applications **Table 2**. On top of that, it has a chemical-resistant surface and a fast, continuous treatment rate [60].

Available in 2 Versions: Fast pickers for the food and pharmaceutical industries are available in the M-430iA/4FH and M-430iA/2PH models, respectively. FANUC Robotics makes the M-430i A and Articulated robots [61].

Features and Benefits: Robotic arm designed for cleaning in food and pharmaceutical industries. High-temperature water, corrosive cleansers, and basic cleaners are all protected by a special coating and fastening. The entire device has a very smooth surface that is easy to clean, avoiding the tainting

of bacteria (adjusts to plan rules for food hardware) [62].

Floor and Ceiling Mount, Large Work Envelope: Comparing the M-430iA arrangement to other types of robots, the work envelope is extraordinarily large, allowing for a high degree of adaptation to cell structure. It is possible to mount the M-430iA robots on the floor or on the roof. There are M-430iA robots manufactured by FANUC Corporation, which is based in Japan's Yamanashi Prefecture (Oshino-mura). Mechanization products and services, such as mechanical autonomy and remote frameworks, are offered by the company. Product lines include Fanuc CR Series Collaborative Robots, Fanuc Robot R2000 Series, Articulated Robots M-20iB/25 Series, and Delta-Robot M-1/2/3 Series, as well as SCARA Series [63].

TABLE 2: SPECIFICATION OF M430IA ROBOT [64]

Hollow arm structure	Motors directly coupled to the reducer	Hollow joint construction for reducers	Very high-speed picker	Food grade grease M-430iA	High-speed wrist for m-430ia/2ph
No external links, Same life for links and other inner segments, No danger of harming links, Less extra parts fundamental, Cost saving money on support	Simplified mechanical unit, Reduced breakdown hazard, Compact and dependable arrangement, High exactness and least kick back	Reduced wear of link directing as most reducers have empty development	Dual drive force couple control is applied for J1, J2 and J3	Special food grease to avoid any risk of Damaging food with grease or oil	M-430iA/2PH has a max. J6 speed of 1700 deg/sec

Pharmaceutical Container Replacement Robot: There are many uses for this robot in the pharmaceutical industry, but it is primarily designed to transport containers used in manufacturing. This robot has a capacity of 200 kg for transporting material through containers and requires charging only once per day [65].

A Pair of Robots to Identify and Handle Small Containers on a Conveyer by Visual Stalking and arm Control Abilities, FANUC Ltd: FANCU Ltd., the maker of varied intelligence robots that allowed the robot to handle minor containers on a conveyer, got the METI Minister Award. Food and medical equipment are two industries where this technique is commonly employed [66].

Metal Detector Targets Pharmaceutical Industry: There is a lot of variation in the texture and sharpness of metal fragments. Detecting metals in food and other products is now a requirement in the food and pharmaceutical industries since they can provide a health risk to the consumer. The digestive tract and other organs can be damaged due to this. Some metals are toxic, so even little amounts can be dangerous. In addition, lawsuits brought by harmed consumers can be extremely expensive, and the damage done to a company's reputation by subsequent advertisements can be even more so. Production facilities will also be saved by installing metal detectors. A piece of foreign metal, for example, can have a negative impact on food processing machinery. Metal particles can harm or break blades in crushers, cutters, and blenders, much like they can damage or break blades. Even a single damaged piece of equipment can shut down an entire manufacturing facility until it is repaired, resulting in substantial productivity losses and high repair costs. Goring Kerr DSP Rx screens tablets and capsules from tablet press feed and capsule filling systems, introducing the device of Quadra Coila. It delivers feed height updates between 760 and 960 mm, and angle updates between 20 and 40 degrees. “An open-frame design and a polished stainless-steel finish characterize the framework. For the sake of cleanliness, all pneumatics and cables are kept within the unit stand. The mounting bars' circular shapes help keep bacteria and debris out of the system [67].

Labelling System Targets Pharmaceutical Industry: When it comes to pharmaceutical labelling, it's critical that the goal of the label be clear and concise. Text errors in dosage directions, expiration dates, or ingredient lists can have fatal consequences if they are not followed. In the eyes of the end-users of these products, the drugs are properly branded and the box credibility was not

included. The ramifications of this decision are, once again, grave. Oval glass and plastic containers ranging in volume from 75 to 450 millilitres can be labelled using the Medicines Class Labelling System, which is made of stainless steel. Each label is imprinted with a date and batch number using a laser video jet imprinter for the date and batch number on each label. Systec Vision System, Allen Bradley PLC power, Colour Touch Screen Controller interface, and complete kit validation are all part of the capabilities [68].

Six-Axis Robots suit Class 1 Clean Room Applications: Using the Sensible Console (TM) CX controls and software platform, the Adept Viper (TM) s650 and s850 cleanroom legislation, regulation, monitoring, and packing applications benefit from the precision movement and 6axis stamina. Automated vision and improved networking enable robots to approach customers in the solar, hard drive, LCD, semiconductor, and biotechnology industries [69].

Applications of Robots: Drones (Unmanned Aerial Vehicles) and autonomous underwater vehicles are used in the oil and gas sector, pharmaceutical industry, automotive industry, space research, and film production. Robots are also used in the manufacturing and medical fields. Pharmaceutical companies are increasingly turning to robots in their manufacturing processes. In a pharmaceutical setting, they excel in assembly work and drug discovery. Pharmacist's health and the integrity of their products are safeguarded by these devices. Pharmaceutical research employs robots as well. Using a robotic arm, sample preparation for processes like NMR is now possible [70].

Manufacturing: It is possible to automate repetitive and boring tasks with the help of robots. The manufacturing and process industries are transforming thanks to industrial robots. These machines are filling many more occupations as they improve in speed and efficiency, as well as their ability to test and examine items. They are even being used to assemble tiny electronic components. Mobile phones, appliances, caskets, and electrical cabinets are just a few of the many items manufacturers paint using robots. Repetitive activities such as dispensing acids, mixing and heating, centrifuging, and filtering are ideal for robotic automation in the laboratory because of their repetitive nature. The automation of laboratory procedures can be achieved through the construction of robots. In addition to specimen processing, they can run satellite labs. Robotic hands and arms are commonly used in the laboratory to replicate the work done by a laboratory technician to save time and money. Using robots at various stages of offshore manufacturing has raised the bar for EH&S standards and provided financial rewards. An oil leak is one of the greatest environmental threats, particularly in the offshore environment [71].

Disease Identification: Berg, a forward-thinking biopharmaceutical business in the United States, is utilizing AI in its oncology, endocrinology, and neurology diagnostics and therapies development. Using their AI-based Interrogative Biology platform, they can distinguish between healthy and diseased surroundings using patient biology and AI-based analytics. There are already more than 800 cancer-fighting medicines and vaccines in clinical trials, according to the Pharmaceutical Research and Manufacturers of America (PhRMA). To provide a commercially available battery of emotional tests for use in clinical settings, the Oxford Pivital® Predicting Response to Depression Treatment (PReDicT) project has set out to develop one [72].

Clinical Trial Research: Patients with the right genetic profiles can be found using advanced predictive analytics. Automated clinical trials based on machine learning it is possible for AI to calculate the most efficient sample sizes and minimize data mistakes such as duplicate entries [73].

CONCLUSION: Due to robot applications exploring new horizons such as space exploration, cinema, medicine, and undersea searches, the population of robots is rapidly rising. As the amount of chemicals used in the chemical industry grows, so will the demand for robots to manage these chemicals and limit the health and environmental dangers that may be linked with them. As far as machines go, humans are the most advanced. Artificial intelligence and robots have the potential to have a significant positive impact on the healthcare and pharmaceutical industries in

the future. It will take time for the transition to take place. However, it will gradually take place over the next ten or twenty years. At some point, robots will be unable to compete with human intelligence and originality. Diagnostic imaging, radiology, clinical trials, drug discovery, personalized medicine, and the detection and treatment of rare diseases are just a few of the many fields in which we specialize. The most important areas of study in pharmaceuticals and Healthcare will be robotic pharmacy and medical robots. However, this technological revolution has the potential to have a darker side, which might fundamentally alter how we work and live in the world today.

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