
ROBOTICS

# Table of contents

# List of Illustrations

# Summary

The purpose of this report is to present the definitions of Robotics and subject the history of it in details. Robotics is an interdisciplinary sector of science and engineering which is dedicated to the design, construction and use of robots with all sizes and forms. Our guide will give you a precise grasp of robotics, including different types of robots in all fields and industries all over the world. This document can be read and understood by any person who has a very lite knowledge about technology in general and **AI** (Artificial intelligence) in particular. As technology is progressing, so too does the scope of what is considered robotics.

The main ideas that will be exposed in this report are:

- **The definition of Robotics and its multiple terminologies.**
- **Automation theory and its impact on technology.**
- **AI, deep learning, machine learning and their contribution to Robotics field.**
- **The applications of Robotics in the real life.**
- **Some disadvantages of Robots.**
- **The impact of Robotics on industry.**

A lot of sub ideas will be discussed in this report, all relevant to Robotics. Before reading this document, it is important to be having background about computer science as Robots are strongly linked to this branch of science. Some of the main applications of Robots and Robotics will be discussed in details such as: Cobots (Collaborative robots) and robotic assembly. The origins of Robotics will be discussed in details as it is important to know the origins of what you are dealing with.

By the end of this report, you will be able to tell what robots are, why we use them and what is the importance of them in our present life. And you will have enough knowledge to be able to have a conversation about Robotics and its history. Conclusions of this report: Robots are now considered essential for many industries-Robots can be useful in education-There are some marked disadvantages of Robotics-By the near future, Robots will be in every house.

# Chapter 1: Introduction to Robotics

## 1.1 Purpose:

The aim of this report is to deliver scientific knowledge and information to those who are interested and linked with technology in general and the branch of Robotics in particular. This report also concentrates on revealing the importance of Robots, their advantages and disadvantages especially in workplace. This report also mentions the applications of Robots in our daily life.

## 1.2 Scope:

This report talks about Robotics and almost everything related to it but not in boring details, just the important details are mentioned and discussed. It will not be exaggeration if we say that any ordinary person can read and realize this report as it is not complicated but, on the opposite, it is a simple one.

## 1.3 Procedure:

Writing this report required a great knowledge about Robotics so, books and articles have been read by the authors to be able to write such a document. Internet and web pages were also used to build this report as internet can be a reliable source in many cases.

## 1.4 Background:

Misunderstanding robots is a major problem amongst students who are concerned with it and also it can be considered a problem for researchers who may not know the definition of a robot and the origin of it. This report will erase any misunderstanding about Robotics and robots.

# Chapter 2: An introduction to AI

## 2.1 The academic definition of AI:

Artificial intelligence (AI), the ability to perform tasks commonly associated with intelligent beings by a digital computer or computer-controlled robot. The term is often used to design systems endowed with human intellectual processes. Despite continuous progress in computer processing speed and memory capacity, there are still no programs that can match human flexibility across broader domains or tasks that require a lot of daily knowledge. On the other hand, in performing certain specific tasks, some programs have reached the performance levels of human experts and professionals, so that artificial intelligence in this limited sense is found in applications as diverse as medical diagnosis, computer search engines, and recognition of voice or handwriting.

## 2.2 The common concept of AI:

Artificial intelligence (AI), also known as machine intelligence, is a branch of computer science that seeks to integrate software with the ability to analyze its environment using either predetermined rules and search algorithms or patterns that recognize models of machine learning, and then make decisions based on those analyses. In this way, AI tries to imitate biological intelligence to enable the application or system of software to behave with varying degrees of autonomy, thereby reducing manual human intervention for a wide range of functions.

## 2.3 The beginning of AI in the modern life:

- For a long time, the idea of inanimate objects coming to life as smart beings has been around. The ancient Greeks had myths about robots, and automatons were constructed by Chinese and Egyptian engineers. Modern AI's beginnings can be traced to the attempts of classical philosophers to describe human thinking as a symbolic system. Marvin Minsky, a cognitive scientist at MIT, and others attending the conference were extremely optimistic about the future of AI. "Within a generation [...] the problem of creating 'artificial intelligence' will substantially be solved, AI: The Tumultuous Search for Artificial Intelligence AI: The Tumultuous Search for Artificial Intelligence" (Basic Books, 1994).
- But it wasn't so simple to achieve an artificially smart being. After several reports criticizing AI advancement, government funding and industry interest fell off, a period from 1974-80 that became known as the "AI winter."
- "And the question-answering system of the computer giant Watson won the quiz show "Jeopardy!" in 2011 by beating reigning champions Brad Rutter and Ken Jennings.

- This year, during a Turing test, a competition developed by British mathematician and computer scientist Alan Turing in 1950 as a way to evaluate whether a machine is smart, the talking computer "chatbot" Eugene Gottman captured headlines for tricking judges into thinking he was really skin-and-blood human.
- But the achievement was controversial, with experts in artificial intelligence saying that only a third of the judges were fooled, and pointing out that by claiming that it was an adolescent who spoke English as a second language, the bot was able to dodge some questions. Now, many experts believe that the Turing test is not a good artificial intelligence measure.
- "The vast majority of people in AI who've thought about the matter, for the most part, think it's a very poor test, because it only looks at external behavior, "The vast majority of people in AI who have thought about the matter, for the most part, think it is a very poor test, because it only looks at external behavior.
- Actually, some researchers are now planning to develop an updated version of the test. But the AI field has become much broader than the pursuit of real, human-like intelligence alone.

## 2.4 The main concepts of AI:

### 2.4.1 Machine learning:

- Machine learning is a branch of artificial intelligence (AI) focused on creating applications that, without being programmed to do so, learn from data and improve their accuracy over time.
- A sequence of statistical processing steps is an algorithm in data science. Algorithms are 'trained' in machine learning to find patterns and characteristics in massive amounts of data in order to make decisions and predictions based on new data. The better the algorithm, as it processes more information, the more accurate the decisions and predictions will become. Examples of machine learning nowadays are all around us. Reacting to our voice commands, digital assistants search the web and play music. Based on what we purchased, watched, or listened to before, websites recommend products and movies and songs. Robots vacuum our floors while we're doing it. With our time, something better. Spam detectors prevent our inboxes from being reached by unwanted emails. Systems for medical image analysis help doctors spot tumors that they might have missed. And the road is being hit by the first self-driving cars. More can we expect. Machine learning will drive greater and greater effectiveness in our personal and work lives as big data continues to grow, as computing becomes more powerful and affordable, and as data scientists continue to develop more capable algorithms.

- To create a machine learning application, there are four basic steps (or model). Typically, these are carried out by data scientists working closely with the business professionals for whom the model is being created.

## Step 1: Select and prepare a data set for training

Training data is a data set representative of the information that will be ingested by the machine learning model to solve the problem it is designed to solve. The training information is labeled data in some instances, tagged to call out features and classifications that the model will need to identify. Other information is unlabeled, and it will be necessary for the model to extract those features and assign classifications on its own. The training information needs to be properly prepared in either case, randomized, de-duped, and checked for imbalances or biases that might affect the training. The training subset, which will be used to train the application, and the evaluation subset, which will be used to test and refine it, should also be divided into two subsets.

## Step 2: Select an algorithm for the training data set to run on

- Again, an algorithm is a collection of steps for statistical processing. The type of algorithm depends on the type (labeled or unlabeled) and the amount of data and the type of problem to be solved in the training data set.

Common types of machine learning algorithms for use with labeled data:

- Regression algorithms: Examples of regression algorithms used to understand relationships in data include linear and logistic regression. To predict the value of a dependent variable based on the value of an independent variable, linear regression is used. When the dependent variable is binary in nature: A or B, logistic regression can be used. For example, a linear regression algorithm could be trained to predict the annual sales of a salesperson (the dependent variable) based on its relationship to the education of the salesperson or years of
- experience (the independent variables). When dependent variables are more difficult to classify, another type of regression algorithm called a support vector machine is useful.
- Decision trees: Decision trees make recommendations based on a set of decision rules using classified data. For example, a decision tree that recommends betting on a specific horse to win, place, or show could use horse data (e.g., age, winning percentage, pedigree) and apply rules to recommend an action or decision on those factors.

- Instance-based Algorithms: K-Nearest Neighbor or k-nn is a good example of an instance-based algorithm. It uses classification to estimate how likely a data point is based on its proximity to other data points to be a member of one group or another.

Algorithms for use with unlabeled data:

- Algorithms of clustering: Think of clusters as groups. The focus of clustering is to identify groups of similar records and to label the records according to the group they belong to. This is achieved without prior knowledge of the groups and their features. Clustering algorithm types include the clustering of K-means, Twostep, and Kohonen.
- Association algorithms: Association algorithms discover information patterns and relationships and recognize frequent 'if-then' relationships called association rules. These are comparable to the rules that are used in data mining.
- Neural networks: A neural network is an algorithm that defines a layered calculation network with an input layer in which data is ingested; at least one hidden layer in which calculations are performed provides different input conclusions; and a layer of output. Where a probability is assigned to each conclusion. A network with several hidden layers is defined by a deep neural network, each of which successively refines the results of the previous layer. (For more, see below in the "Deep learning" section.

Step 3: The algorithm training to create the model

- It involves running variables through the algorithm, comparing the output with the results it should have produced, adjusting weights and biases within the algorithm that could produce a more precise result, and running the variables again until most of the time the algorithm returns the correct result. Training the algorithm is an iterative process. The machine learning model is the resulting trained, precise algorithm-an important distinction to note, because 'algorithm' and 'model' are used interchangeably incorrectly, even by machine learning mavens.

Step 4: To use and enhance the model

- The final step is to apply new data to the model and, in the best-case scenario, to improve its accuracy and efficiency over time. The problem being solved will depend on where the new data comes from. For instance, email messages will be ingested by a machine learning model designed to identify spam, while a machine learning model driving a robot vacuum cleaner will ingest data resulting from real-world interaction with moved furniture or new objects in the room.

### **2.4.2** Deep learning:

- Deep learning is a technique of machine learning that teaches computers to do what comes to humans naturally: to learn by example. A key technology behind driverless cars is deep learning, which allows them to recognize a stop sign or to distinguish a

pedestrian from a lamp post. In consumer devices like phones, tablets, TVs, and hands-free speakers, it is the key to voice control. Lately, and for good reason, deep learning is getting a lot of attention. It's achieving outcomes that were previously not possible. In deep learning, a computer model learns directly from images, text, or sound to perform classification tasks. Deep learning models, sometimes exceeding human-level performance, can achieve state-of-the-art precision. By using a large set of labeled data and neural network architectures that contain many layers, models are trained.

- Neural networks are node layers, much like neurons are made up of the human brain. Nodes are linked to adjacent layers within individual layers. Based on the number of layers it has, the network is said to be deeper.
- In order to return accurate results, deep learning systems require large amounts of data; accordingly, information is fed as huge data sets. Artificial neural networks can classify data when processing the data with the answers received from a series of binary true or false questions that involve highly complex mathematical calculations. For example, by learning to identify and recognize edges and lines of faces, a facial recognition program works, then more important parts of the faces, and finally, the overall representations of faces. The program trains itself over time, and the likelihood of correct answers increases. In this case, with time, the facial recognition program will identify faces accurately. Let's say that the goal is to have photos containing a dog recognized by a neural network. All dogs do not look exactly the same. For example, consider a Rottweiler and a Poodle. In addition, photos show dogs at various
- angles and with different amounts of light and shadow A training set of images must therefore:

  be compiled, including many examples of dog faces that any individual would label as "dog," and images of objects that are not dogs, labeled (as one might expect), "not dog." The images are converted into data fed into the neural network. Such information passes through the network, and different nodes assign weights to various elements. The final output layer compiles the information that is seemingly disconnected-furry, has a snout, has four legs, etc.-and provides the output: dog. This answer received from the neural network will now be compared with the label generated by humans. If a match exists, the output is then confirmed. If not, the mistake is noted by the neural network and the weightings adjusted. By repeatedly adjusting its weights over and over again, the neural network tries to improve its dog recognition skills. This technique of training is called supervised learning, which happens even when a dog is not explicitly told what “Makes" the neural networks. Over time, they have to recognize patterns in data and learn on their own.

### 2.4.3 Artificial neural network (ANN):

An artificial neural network (ANN) is a computer system designed to simulate how information is analyzed and processed by the human brain. It is the basis of artificial intelligence (AI) and solves problems which, by human or statistical standards, would prove impossible or difficult. ANNs have self-learning capabilities that allow them, as more data becomes available, to produce better results.

# Chapter 3: An Introduction to Robotics

## 3.1 The Academic Definition of Robotics:

Before getting deep in any branch of science it is necessary to be aware of it is academic well-defined definition. Scientists and researchers are always keen to define what they are dealing with. The knowledge explosion that has occurred in the field of robotics, during the first half of the 1980s, raises the question: 'Should robotics become a separate discipline?'. When it comes to a (relatively) modern science like Robotics, it has more than one definition. Although everyone seems to know what a robot is, it is hard to give a precise definition but the definition of the discipline of Robotics is:

***Robotics is the scientific and engineering discipline concerned with the creation, composition, structure, evaluation, and properties of embodied artificial capabilities.*** Also, it can be defined as:

***Robotics is an interdisciplinary field that integrates engineering and computer science. Robotics involves design, operation, construction and use of robots of all forms and sizes.***

The expert **Mel Siegel** also added a very simple and satisfying definition as he defined Robots as machines that think, sense, act and communicate.

Getting to know the origins of Robotics starts with acknowledging where the word itself came from. The word Robotics is derived from the word robot, which was introduced for the first time to the public by Czech writer Karel Čapek in his play R.U.R. (Rossum's Universal Robots), which was published in 1920. And according to the Oxford English Dictionary, the word Robotics was first used in print by Isaac Asimov, in his science fiction short story "Liar!", which was published in May 1941 in Astounding Science Fiction. The fact that a very complicated and difficult science that deals with Artificial intelligence was first mentioned in a play is like a comic fact but it is difficult to be sure about the origins of a specific word.

A robot also has its own definition as it is any automatically operated machine that can replace human effort, though it may not resemble human beings in the appearance or perform functions in a humanlike manner. And it also can be defined as a machine that is capable of carrying out a complex series of action automatically more efficiently and with less percentage of error due to machine learning and Artificial intelligence technologies that help robots to take some decisions.

## 3.2 The importance of Robotics:

**Why is Robotics important?** It is a logical question that can pass across your head when you are studying this science as it is essential to know the effect of what you are learning or what you are researching in the real life. Robotics technology influences every aspect of home and work. Also, Robotics has the potential to positively transform lives and work practices, raise efficiency and safety levels and provide enhanced levels of service. Even more, Robotics is set to become the driving technology underpinning a whole new generation of autonomous devices, machines and cognitive artefacts that, through their learning capabilities, interact seamlessly with the world, and hence, provide the missing link between the digital and physical world. Robotics is already the key driver of competitiveness and flexibility in large scale manufacturing industries. Without Robotics many of Europe's successful manufacturing industries would not be able to compete from their current European bases of operation. In these industries Robotics underpins employment. Increasingly Robotics is becoming more relevant for smaller manufacturing industries which are central to Europe's manufacturing and employment capacity.

Robotics has a very important role in the educational process in the few past years. In the school setting, robots encourage problem-solving, creative thinking, and a healthy sense of competition that drives innovation from students. Here are some of the most important contributions of Robotics to (almost) every field in this life:

*Fig1. Autonomous agricultural robot*

- **AGRICULTURE:** Some advanced robots distinguish field weeds from crop plants and eliminate the need for genetically modified crops or untargeted spraying with herbicide.
- **FOOD SERVICE:** Robots can perform on the factory floor and elsewhere, even as an espresso machine that fills traditional orders.
- **ENVIRONMENTAL RESEARCH:** Modern robots collect data from ocean surfaces and underwater. And also used to operate during storms and safeguarding human lives
- **HEALTHCARE:** Robots help monitor patients to direct nurses and also doctors to the patients most in need.
- **REHABILITATION:** Bionic parts (robots) are helping paraplegics walk again
- **SOLAR:** Robots help harness energy at solar farms where extreme weather makes manual monitoring a difficult operation.

**Why we use Robots?** A logical and realistic question that must be answered. Robots offer numerous benefits including:

- **INCREASED ACCURACY:** When programmed robots are able to repeat the same task over and over again without deviation or any error, this means fewer rejected parts.
- **LOWER COSTS:** With increased productivity, accuracy and efficiency come cost benefits as well, so robots help facilitate more work being completed in less time.

## 3.3 The main applications of Robotics:

Robotic applications are now being used in an increasing variety of industries around the world. With the supply of robots increasing and being more readily available, the opportunity for different sized businesses to own a specific type of robot has increased significantly. The basic laws of economics state that with the overall price of automated machines falling, the demand by businesses and personal consumption will continue to rise.

### The main types of Robots:

**3.3.1 Collaborative Robots:** Collaborative robots (cobots) are a form of robotic automation which is built to work safely alongside human workers in a shared, collaborative workspace. In most applications, a collaborative robot is responsible for repetitive, menial tasks while a human worker completes more complex and thought-intensive tasks. The accuracy, uptime and repeatability of collaborative robots is designed to complement the intelligence and problem-solving skills of a human worker. The designs of cobots differ greatly from one industry to another. Featuring force limitations, rounded edges, and light weights. collaborative robots are first and foremost designed for safety. Most collaborative robots are equipped with a series of sensors which are used to avoid collisions with human workers, as well as safety protocols to shut down if any form of unplanned contact occurs.


*Fig2. Collaborative robot*

**3.3.2 Robotic assembly:** Assembly robots are used for lean industrial processes and have expanded production capabilities in the manufacturing world. An assembly line robot can increase production speed and consistency. They also save workers from dull assembly line jobs.

**3.3.3 Material removal:** deburring, cutting, grinding, sanding, polishing and routing are some examples of material removal applications. Applications range from harsh, abrasive methods to smooth out steel to precise, careful spot removal techniques for small parts like jewelry. Material removal robots help manufacturers raise the safety level in their shops by getting workers away from harmful dust and fumes associated with the material removal tasks.

**3.3.4 Part transfer and machine tending:** Machine tending is one of the most popular collaborative robot applications. The basic definition of tending is to provide treatment for someone or something. A robotic machine-tending process can be repeated infinitely, assuming that the robot continually receives raw parts and the machine produces quality parts. Also, machine tending refers to the automated operations of industrial machine tools in a manufacturing plant, primarily using robot automation systems. While loading and unloading is the primary function of machine tending systems. There are several benefits of machine tending: increasing the productivity, operational flexibility and enhanced safety.

## 3.4 The sciences related to Robotics:

Robotics is a very wide science which is linked and related to various fields and sciences. Robotics integrates fields of electrical engineering, mechanical engineering, information engineering, mechatronics, electronics, bioengineering, computer engineering, software engineering, control engineering, and many other sciences. Artificial intelligence is the main science that deals with Robots as they are intelligent machines (by definition) and they are being provided with many concepts and technologies from Artificial intelligence science. Deep learning is also from the main fields related to Robotics. Deep learning is the science of training large artificial neural networks. Deep neural networks (DNNs) can have hundreds of millions of parameters [1, 2], allowing them to model complex functions such as nonlinear dynamics. Applying deep learning to robotics is an active research area, with at least forty papers published on the subject from 2014

through the time of this writing. The philosophy that prevails in the deep learning community is that every part of a complex system can be made to “learn”. when each part of a system is capable of learning, the system as a whole can adapt in sophisticated ways.

The idea of using machine learning in controlling robots requires humans to be willing to give up a degree of control. This can seem counterintuitive at first, but the idea of doing so is that the system can then begin to learn on its own. The robotics community has identified numerous goals for robotics in the next 5 to 20 years. These include human-like walking and running, teaching by demonstration, mobile navigation in pedestrian environments, collaborative automation, automated bin/shelf picking, automated combat recovery, and automated aircraft inspection and maintenance, and robotic disaster mitigation and recovery and many other useful applications. AI is set to disrupt practically every industry imaginable, including Robotics industry. There are four areas of robotic processes that machine learning is impacting to make current applications more efficient and profitable. The scope of AI in robotics includes:

- **Vision:** AI helps robots to detect items they’ve never seen before and recognize objects with far greater details.
- **Grasping:** robots are also grasping items they’ve never seen before with AI and machine learning helping them determine the best position to grasp an object.
- **Motion Control:** Machine learning helps robots with dynamic interaction and obstacle avoidance to maintain their productivity.
- **Data:** AI and machine learning both help robots understand physical and logistical data patterns to be proactive and act accordingly.

# Chapter 4: The history and evolution of Robotics

## 4.1 The first appearance of the word Robotics:

- It is not strange for us if we say that all modern scientific innovations and inventions in the field of artificial intelligence and all the tremendous progress that humanity has reached in this field had its beginning in a fictional novel, and this is not new or strange because most of the discoveries and innovations that exist in the scientific community were one day Just an idea or wish for some thinkers or writers, and this is the same case in the field of artificial intelligence.

- The word robot appeared for the first time in our life in 1920 in a play novel by Karl Chapik, and the play was about living machines, and then this word spread in other novels and science fiction films. This aroused the curiosity of scientists to imagine the relationships that could happen between humans and these living machines, so they decided to invent something like this. But dear reader, you may ask yourself. Is this only the history of the invention that is called a robot? This is what we will explain in the paragraph coming with a bit of detail.

*Fig.3 Karl Čapek*

## 4.2 Early conceptions of Robots:

- We go back to the pre-birth era in a civilization that history has witnessed that it is the greatest civilization of the earth, which is the ancient Egyptian civilization, and every day we discover about this wonderful civilization amazing things, and the most important of these amazing things related to the field of robots is that in 1500 BC a statue of one of the kings of this civilization was invented (King Memnon) and this statue made musical sounds every morning and it is not the best thing, but in his time it was considered a breakthrough in human history. We talked about the ancient Egyptian civilization.

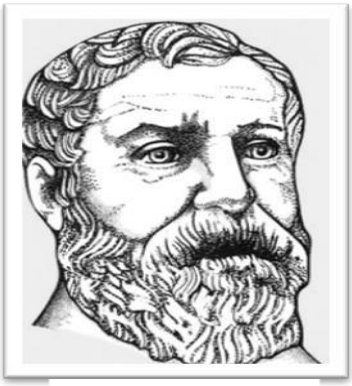

*Fig4. The Greek scientist Heron of Alexandria*

- We go to a civilization that is no less than the ancient Egyptian civilization in something, which is the Greek civilization, which was famous for the powerful philosophers such as Plato, Aristotle and others, but what we do not know about this civilization is that a Greek scientist called Archettas (mathematician) invented a dove that is capable of flying for very short distances, this happened during the fourth century AD. But the Greek civilization did not depend on this only, but the Greek inventor and mathematician Ctesibius invented a lot and a lot in the field of robotics, but the most important of which is that it developed the water clock (a tool that measures time by regulating the flow of a certain liquid into or out of a jar according to the type of flow), which it was called at the time by the name of Klepsydra, so he
  developed it by providing it with a device that makes the water level constant and thus it became one of the most ancient clocks to accurately calculate time, before the invention of the German physicist Christian Hughens the pendulum.

- From the year 10 AD to the year 70 AD there was a breakthrough at the hands of the scientist Heron the Alexandrian, and this scientist invented things that you can say very wonderful, beauty and science, so he invented a machine that works with the flow of water and steam, and this is in addition to his most important invention, a machine that is considered as the first form of the turbine that is powered by the power of steam and this invention was famous for which the scientist Herron. Scientists considered him one of the brilliant inventors in the world of robotics.

- We leave the pre-Christian era and the advanced Gregorian eras and go to after the birth of the Prophet Muhammad, may the best prayers and peace be upon him in the Middle East, where one of the most important scholars of the Islamic nation was born in 1136 and is considered one of the greatest engineers, mechanics and inventors in history, Al-Jazari , so far from this, AlJazari is considered My father, the robot) for his efforts in this field, and these efforts include in the Risalah al-Jazari book, which contains within it the secrets of the automatic devices that the Arabs invented and took one of these devices that he talked about in detail in his book and called it (the peacock fountain) and this machine was used for hand washing and it was The water, soap and towel are provided in a mechanical

*Fig5.Al-Jazari scientist*

way, And also one of the most important inventions invented by the great Al-Jazari scientist in 1206, selfoperating machines that can be programmed, and this without any doubt is considered one of the most important inventions that opened the door for this field to enter our great world and from this invention it is possible to say the true history of robots began, and with this we leave the ancient times and take a tour of the Middle Ages and the Modern.

- And we go to Europe in the Middle Ages, which is considered one of the ages of darkness and injustice in Europe, but the scientific community had a different opinion in this regard, as it showed the idea of robots capable of helping humans in affairs. Their lives clearly. In fact, philosopher Albert Vagnus and Roger Bacon began with a deep and detailed study of autonomous machines. Those who move without human intervention and have actually made quite a few of them. Work continued on this project from other scientists until they reached the invention of the automatic clock at the end of the thirteenth century, and this invention is an extension of self-moving machines with the necessary mechanical strength and continuous attempts one

after the other until they reach where we are, which is the clock that rings bells to announce the time. As in the case of Big Ben in the British capital, London. At the same ages, the famous scientist and talented painter, Leonardo Da Vinci, invented in 1495 AD the first design for a robot in shape and appearance and called it the Knight Robot.

- And we pass through time not a little to look at the year 1738 AD where a man named Jacques de Foxon invented a large number of automatic machines that collect music It enables him to speak and speak as well as write and play chess. That same year he also created a duck capable of moving its wings and pulling it out on its own, as well as designing a robotic loom, but it did not complete it. In the year 1801 AD, the French scientist Joseph Marie Jacquard took this idea to develop it and work to improve it as much as possible to highlight it, which is a programmable fabric like other devices such as computers today.
  Let us turn to the eighteenth-century AD to know that Europeans used two machines to apply the principle of feedback.

*Fig6. Leonardo's robot*

- Let's jump to the nineteenth century, when a Japanese scientist named Tanaka Hisashiji invented the mechanisms that perform multiple functions, including serving tea, serving customers, shooting arrows, and other relatively simple works. These mechanisms were called Karakuri games. All that we talked about in the previous paragraphs was about the beginning of the field. As for what we will talk about in the coming paragraphs, it is considered as the amazing things and the wonderful things that we see, and we may know a little about them through cinematic films or even some fictional novels. In the twentieth century we will say with all certainty that the imagination that the novels talk about has already become real in our world and around us. Let us start with the first British robot that somewhat mimics the shape of humans, as it was designed by the inventor William Richards and aircraft engineer Alan Reville in 1928 during the First World War and this robot was called by the name of Eric, and this robot traveled to countries Many - before it disappeared _ including the United States of America in 1929 AD, and as we said that it disappeared for unknown reasons, but it was brought back to light in one of the exhibitions of robots in 2017 AD.

*Fig7. Electro robot produced by Westinghouse Corporation*

- From here the world seemed to know the importance of this field and the businessman began to invest in this terrible field and it was the establishment of large companies related to this field of these companies, the American company Westinghouse, which created the electronic robot during the years 1937 and 1938 AD and this robot is one of its characteristics that it is a human appearance It can be operated by voice commands from humans and was speaking about 700 words or more, and it can smoke and blow-up plastic balloons. Mansfield Memorial Museum.

- In 1948, what a year full of surprises at the technical level, so the neurobiologist William Gray Walter, an American national, built two electronic robots called Elmer and Elsie, but this time it is not limited to moving arms and doing simple actions that simulate simple human actions. These two robots are thinking, meaning they think, They are able to make the fateful decisions that humans make, which distinguish humans from the rest of the creatures on the face of the earth, and are considered the first robots in history that were programmed to think to function like the human brain, and this means that it has free will.

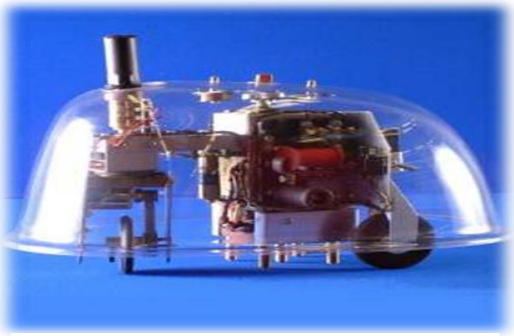

*Fig8. The Elmer and Elsie robot of neurobiologist William Gray Walter*

- In 1956 AD we are witnessing the birth of a new type of robots, which are industrial robots that are indispensable in our times in advanced factories and companies, and it is the Unimite robot, which was designed by the scientist George Devol, who seriously called robots for his invention of this very important robot. This type of robots is programmed for work. Industrial industries that are difficult for a person to master, such as car factories and foodstuff factories.
- After this amazing invention, businessmen were encouraged once again to improve this field, so Fuji Yusuke Kogyo created the Waltzer robot, which is a huge, self-controlled transport platform, and this was in 1963 AD, this is the period of the field of robotics until the year 1973 AD for the German company Kioka to manufacture the robot Famulus as the first industrial robot with a self-propelled six-axis electro-mechanical drive. And last but not least, coming to 1975 AD, the Unimation company produced the Puma robot, which is a programmable arm, and this arm was invented by the scientist Victor Scheinman and was based on the designs invented by Scheinman during his stay at Stanford University. We finished the history of robots and its idea through different ages and passed through all ages to search for the most important robots that were created in these periods and tried as much as possible to collect some details about each of the robots mentioned in this paragraph, but it does not mean that we have finished the paragraph is that there are no robots Others No, of course, there are many robots that we will talk about in some other chapters in this wonderful article.

## 4.3 The definition of Automata and Automata theory:

- After that we go to the scientific theories used in operating and moving robots, which is the most important theory ever to operate robots, which is the theory of autonomy, which is a theory that can be defined as being concerned with studying and understanding different computers in order to be programmed to operate themselves by themselves. This theory is of great importance to robotics scientists and must be They master it perfectly, not as we believe that this theory can be applied to robots only, but it can also be applied to computers, as it contributes to solving many problems that programmers face in their work, including that it gives them solutions to design programs to ensure the health and safety and ensure digital electronics and programs to understand And realizing many pages on the Internet and searching for certain words in search engines, such as those you search for every day on the most popular search engine Google.

- To simplify matters more, we can say that we have a device such as a television set that can be turned off or turned on by pressing an electronic button. The two states of turning off the television and turning on the television can be represented in the two states (off, on) respectively, so the television remains in one of the two cases until someone presses the button to convert it to the other state. Let's assume that The machine (television) begins with the state of (extinguished), so as we notice there is an arrow (start) indicating this state, and this simple drawn diagram calls the states of each of these cases describing a specific situation for a machine at a time and the arrows that appear between the state of (the logical) and (the operator) Income is called income, and it represents the external influences that change from TV situations with the passage of time. We have here only one input symbol, which is (press) and it transfers the machine from the switched off state to the operator and this is a simple example of applying the theory of self-operation in our daily life, but this theory is not limited to this The simple things only, but extends to many more and more complex inventions, and we do not want to go to them.

## 4.4 Introducing the Human-robot interaction:

- The interaction of the human being and the human being is one of the things that need to be taken into account. He is interested in studying the communication between the human being and the robot in the realm of science. Different academies around the world and international universities and the human robot were mentioned separately for the first time in the 20th century in a book by author Isaac Asimov in 1941 in his novel (I am a robot) and through this book the author developed three laws for robots, and they are as follows:
    1. The robot must not harm a person, or fail to perform an action that his failure to do may cause harm to the human being.
    2. The robot must obey commands given by humans, unless these orders conflict with the first law.
    3. The robot must protect its existence, as long as this protection does not conflict with the first or second laws.

- These three laws define the safe interaction between humans and robots, and the greater the closeness between humans and robots, the more complex the matter becomes, the greater the risk to humans, and now in our present time, robotics manufacturers are trying to avoid this dilemma by not placing humans and robots at any time in a work space, but with the development of science Artificial Intelligence It is possible for some robots to have high-precision and sophisticated behaviors, and the goal of this matter is to create safe environments for human interaction with the robot and understand each other about what is meant and try to reach the maximum errors in this communication and from here we know that communication between humans and robots is not an easy matter Absolutely, but it requires extensive work to reach the maximum result in this matter.

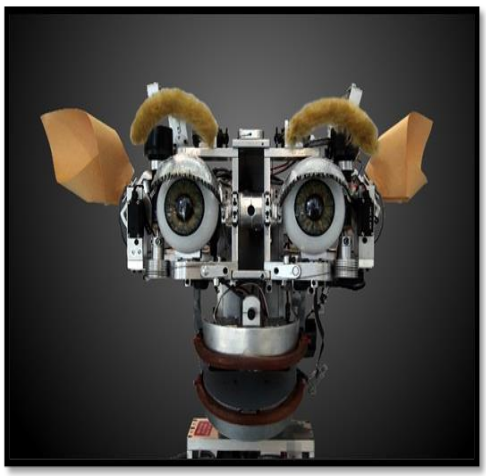

*Fig9. Kismet the robot*

## 4.5 The industrial revolution of Robots:

- At the end of this chapter, we want you to be fully aware of what is happening around you of huge and gigantic industrial revolutions but let me take you to the beginning of the matter. The second industrial revolution occurred due to the use of steam and water in the production of electricity and energy, and this is a very big and giant achievement at the time of its emergence and then in the beginning of 1969 The third revolution occurred, and the emergence of electronics and computers, and here we are now in the fourth industrial revolution, as they say about it, the digital information revolution, as a result of the overlapping of different fields with each other and the presence of technologies capable of transcending the boundaries of these fields. This is the reality in which we live as you see and now the investments in the field of robots Artificial intelligence is in the millions and even billions of dollars that are difficult to imagine in the minds, and it is estimated that in 2022 the robotics industry will provide about 30 million job opportunities, such as data analyst and programmer, efficient applications that depend on technology in general and some emerging disciplines for machine education and information security, according to For the Robotic Industry Association, a global number of robots were shipped to North America in 2018 and saw an increase of 1% 5% for the year 2017 AD and the manufacture of types of robots opens the door to the creation of types of them, for example there are robots for industry, robots for medicine, robots for household work ..... etc. and more investments and these are some of the types of robots and every day a new type of them appears that we must know about even if Even a few, and in terms of companies producing robots, there are many companies of different nationalities, including the US company I Robot, contracted with the US Defense Ministry with a contract of thirty million dollars for one year, as well as the famous company in the world of software, Google. You may know for the first time that the US company Google is involved in the robotics industry and also many of the other advanced companies specialized in this field.

- At the end of this chapter, I hope, dear reader, that you have learned even a small part of this interesting chapter related to the history of the creation of robots. We also got to know who put the word robot in the world and its

spread. We also got acquainted with the theory of autonomy, which is one of the most important theories in this field. Another is the interaction between humans and robots and the safe relationships between them. Finally, we got to know the industrial revolution of robots and how important it is for developed societies, but wait, do you know how to program different robots to perform the required function? So come let us go to Chapter Four to learn about that interesting and interesting thing.

# Chapter 5: Machine Learning & Control of Robotics

## 5.1 Starting Machine Learning:

In recent years, machine learning and pattern recognition algorithms have grown to become a working horse in brain imaging and computer neuroscience, as they are instrumental in mining vast quantities of ever – measurement accuracy neural data and detecting tiny signals from a daunting sound floor. They provide the means of decoding and characterizing the required mission.

### 5.1.1 Uses of machine learning in our life:

- **Traffic handling:**

  AI excels in logistics management, and one of the most complex and demanding parts of logistics to grasp is handling a city's traffic. In order to ensure that the trains run on time, traffic lights operate properly and maintenance is carried out where and when necessary, millions of data points and thousands of commuters must be properly accounted for. Machine learning needs to be at the heart of the transportation system in many modern cities. To create efficient ML models, data such as rush hour variations, road wear and tear, and current maintenance schedules can be used. Ultimately, these models help enhance the flow of traffic, increase the use and reliability of sustainable transport modes, and minimize real-world disruption by modelling and modelling.

- **Creating video games:**

  Rather than many others, the video game industry is continuously pushing the technical norm to present the best player experience. In their games, developers are no strangers to using simplistic AI algorithms. Now, with no underlying game engine required, AI is even developing real-time games for players to interact with. NVIDIA researchers trained an AI on 50,000 playthroughs of the game for the $40^{th}$ anniversary of Pac-Man, with the end result being a fully ML-powered version of Pac-Man-This technology goes way beyond recreating, of course, arcade classics. Game developers can use the underlying technologies to add information in real-time to environments, build enemies that can learn from the behaviors of players dynamically, or create whole levels that change dynamically based on the actions of players.

- **Social media moderation:**

  For a number of organizations that deal with customer service problems, proper moderation, filtering, and routing of messages has been a problem and has been a particularly difficult problem for social media sites, with no real solution proving to be feasible, at least not until now. Facebook has turned to artificial intelligence to help keep its site in place, with the current atmosphere of disinformation surrounding COVID-19 and the widespread use of hate speech on online platforms. In a function like that of the human moderators, some of whom it replaces, the AI they created will act. The algorithm of Facebook is qualified to identify hate speech and misinformation for fact-check. Duplicate images are some of the key characteristics it searches for., often suggesting a meme or infographic that is shared on the web by bots or trolls. The problem with this approach is the possibility of banning photos and memes using the same format, even though they are not used for malicious purposes. Although researchers hope that the AI will be able to identify when a post is similar but not the same as banned content, in many instances, this is still a job for people. Machine learning, however, makes it much easier for moderators to properly track Facebook and other sites for social networking.

- **Tutoring students:**

  The current COVID-19 pandemic is forcing students and teachers to adapt, particularly when not in person, to new ways of learning and teaching. Luckily, in this new teaching environment, AI is proving an invaluable method. A machine learning tutor was developed by researchers at Carnegie Mellon University who can dynamically learn from a teacher by trying to solve problems on their own and using corrections from their teacher to extrapolate solutions to other problems, as well as alternative approaches to solve the problem that even the teacher might not have thought of. The AI will then use the various techniques it has learned in the same way to teach students and respond to any difficulties the students might have. For example, if a student has trouble understanding the order of operations in a larger math problem, AI may dynamically respond to the particular question of the student in a way that a video or virtual class would not be able to do effectively.

- **Developing new scents**:

  The option of incorporating AI into their processes is a no-brainer for perfumeries. Perfumes are a delicate balance between art and chemistry, and machine learning helps to effortlessly and cost-effectively combine the two. A custom-built ML model with data collected from customers is used by one

fragrance startup, Scentbird, to create customized and exclusive scents for testing its human counterparts. Another business, Symrise, is called Phylra, with its own dedicated AI perfumer. While the ML models of Scentbird create scents for human approval, Phylra is free to make its own choices and determine how consumers respond to fragrances on their own. ML also helps to define where alternative products can be found, bringing down the production price by using more natural, environmentally friendly ingredients.

### 5.1.2 Types of machine learning:

- **Supervised Learning:**

  One of the most basic forms of machine learning is supervised learning. The machine learning algorithm is trained on labelled data in this form. Although the information needs to be correctly labelled for this strategy to work, when used in the right situations, supervised learning is extremely effective. In supervised learning, a small training dataset is given to the ML algorithm to work with. A smaller part of the larger dataset, this training dataset serves to give the algorithm a basic understanding of the problem, solution, and data points to be dealt with. In its features, the training dataset is also very similar to the final dataset and gives the algorithm the labelled parameters needed for the problem. Then the algorithm finds correlations between the specified parameters, effectively creating a relationship of cause and effect between the variables in the dataset. The algorithm has an understanding of how the data works and the relation between the input and the output at the end of the training. For use with the final dataset, this solution is then implemented, which it learns from in the same way as the training dataset. This implies that even after being deployed, supervised machine learning algorithms will continue to evolve, finding new patterns and relationships as they train on new data.

- **Unsupervised Learning:**

  The value of being able to work with unlabeled data is Unsupervised Machine Learning. This ensures that human effort is not needed to make the dataset machine-readable, enabling the software to operate on much larger data sets. The labels help the algorithm to find the exact nature of the relation between any two data points in supervised learning. Non-supervised learning, however, does not have labels to function off, resulting in secret constructs being formed. The algorithm perceives relations between data points in an abstract manner, with no feedback required from human beings. What makes unsupervised

learning algorithms flexible is the construction of these hidden structures. Unsupervised learning algorithms can adapt to the data by dynamically changing hidden structures instead of a fixed and set problem statement. This provides more post-deployment production than algorithms for supervised learning.

- **Reinforcement Learning:**
  Reinforcement learning is directly influenced by how human beings in their lives learn from data. It features an algorithm that uses a trial-and-error approach to refine itself and learn from new circumstances. Favorable outputs are supported or 'strengthened' and discouraged or 'punished' are non-favorable outputs. Reinforcement learning works by placing the algorithm in a work environment with an interpreter and a reward system on the basis of the psychological principle of conditioning. The output result is given to the interpreter in every iteration of the algorithm, which determines whether or not the outcome is favorable. In the event that the program finds the right answer, the interpreter improves the solution by supplying the algorithm with a reward. The algorithm is forced to reiterate before it finds a better answer if the outcome is not favorable. In most situations, the reward system is specifically related to the outcome's efficacy. The solution is not an absolute value in traditional reinforcement learning applications, such as finding the shortest route between two points on a map. It instead takes on an efficiency ranking, expressed in a percentage value. The higher this percentage value is, the more the algorithm is compensated. The software is therefore trained to offer the best solution possible for the best possible reward.

### 5.1.3 Understand how machine learning can help in business problems:

- **Predictive Maintenance:**
  Manufacturing companies follow preventive and corrective maintenance measures on a daily basis, which are also costly and ineffective. With the advent of ML, however, businesses in this sector may use ML to find meaningful insights and trends concealed in their factory data. This is referred to as predictive maintenance and helps to reduce the chances of unforeseen failures and minimize excessive costs. The ML architecture can be developed using historical data, a visualization tool for workflows, a scalable research environment and a feedback loop.
- **Eliminates manual data entry:**
  Some of the biggest challenges faced by THE companies today are duplicate and incorrect details. Any errors caused by manual data entry can be substantially avoided by predictive modelling algorithms and ML. Through using the data

found, ML programs render these processes easier. The staff may then use the same time to perform duties that add value to the organization.

- **Spam Detection:**
  Machine learning has been in use for quite some time to detect spam. Email service providers have traditionally used pre-existing, rule-based approaches to filter out spam. Spam filters, however, are now developing new guidelines for identifying spam and phishing messages by using neural networks.
- **Medical Diagnosis:**
  Several healthcare organizations have been supported by ML in medical diagnosis to improve the health of the patient and minimize healthcare costs, using superior testing instruments and productive treatment plans. In healthcare, it is now used to make an almost perfect diagnosis, forecast readmissions, prescribe medications, and classify patients at high risk. These forecasts and observations, along with the symptoms displayed by the patient, are drawn up using patient records and data sets.
- **Increasing Customer Satisfaction:**
  ML can help improve consumer loyalty and guarantee superior customer service as well. This is done by using the previous call logs for customer behavior analysis and based on the accurate assignment of the customer requirement to the most relevant customer service executive. This dramatically decreases the expense and the amount of time spent in customer relationship management. For this purpose, major companies use predictive algorithms to give recommendations for goods they want to their consumers.

# Chapter 6: Robotics applications and usage

Workplace robotics have a high degree of accuracy, robots can be used in chemical manufacturing, chemical spills, nuclear plants, etc. By working in dangerous environmental conditions such as polluted climate, storing and cleaning of radioactive waste, they help reduce company losses. Robots can repeat the assignments every number of times a day without being tired.

## 6.1 Advantages of Robotics Applications in the Workplace:

Robots are cheaper than humans and their cost is now declining, if you run an essay writing service, you can use robots to do any kind of research relevant to any topic. Robots are more involved and do not get tired like humans, absenteeism can be minimized by cooperation between humans and robots, human speed cannot increase, thus robots support humans.

Robots are stronger and quicker than humans, they are more accurate than humans, they do not move or shake like human hands, robots have smaller and more flexible movement components that allow them execute tasks more accurately than humans, robots come in any shape and scale, depending on the task's need.

They can run under whatever environmental situation, whether it is vacuum, underwater, in intense heat or wind, etc. They can be used anywhere human safety is a big concern, they are human programmed; they can be used for any unsafe and unwanted job where people can fail to provide their services, many robotic samples have been sent into space but have never returned.

Robots have proved to be very effective in combat, they can save more lives, they can never get tired and can actually work 24 x 7 on certain tasks, the human brain gets tired and wants rest, unlike robots, robots work on certain tasks without making any errors that are the best thing about them. In comparison to human beings, they act at a comparable pace during the day, and their energy never fades away.

The job is performed in a partnership that reduces the worker's time by up to 85 percent. In the lightweight mission, collaborative robots are employed to support the staff, carry the parts for the operators and attach the fasteners to the goods created.

Robots tend to save time, they may do the job that is challenging and risky for humans, the human body can get injured, so the robotic machine can definitely not get hurt, they would operate at

constant speed, so robots would actually do the complicated tasks. The human body cannot work as efficiently as the robotic machines would do.

More products are produced in less time, machines can run quicker than humans, resulting in more completed products than can be achieved manually, helping to maximize demand, decrease the production of faulty goods; manufacturing equal quality products in less time and more precision.

In working, robots are versatile, they will operate under unfavorable scenarios, but the human could not do this, so the position where the human has little reach, the robots are used, sent and the job is accomplished. So, in any case, they are versatile.

## 6.2 Disadvantages of Robots in the Workplace:

If the human workers are not tied up doing the tasks that should be left for robotics, they will be accessible & efficient, they will speak to consumers, answer emails & social media messages, assist in branding and promotions, and sell goods, the robots need humans for oversight & control, they will not do anything, Certain jobs need to be done by the human. While robots in the workplace can improve productivity in many firms, the unemployment rate can increase, unemployment in the country increases as manual labor decreases and Robots does all the work, Robots decreases the chances of jobs in industry, in many factories and manufacturing plants human labor is no longer needed. The bad workers do not have some job to do, but they get worse, the owners get the job in no time, with better productivity and more efficiency, making them wealthier day by day. Robots have no sense of feelings or consciousness, they lack empathy, they can perform their assigned duties, but they cannot cope with unforeseen circumstances.

Robots can be a threat, since no one can trust a robot as it does not have a human brain that can think before doing it, if anything goes wrong, whatever is fed through chips to the robots is done. Once the computer is destroyed, confusion will take over the whole organization.
The cost of supplying robotics is very high, it's not a child's play to buy the robots and the robotic devices, not all enterprise can afford the same, so those who can afford it are a boon for them, but those who can't buy have to face the tough competition. That lags behind them, giving them no place in the market. It costs more to maintain the equipment than to mount them, and this can’t be afforded by all companies as the profits are not always raining incessantly.

Financial budget rises than anticipated, then it places the company in great financial problems leading the company to bankrupt, which is a massive unbearable failure for any corporation, the robot's repair expense is high, while the company itself is reeling under the burden of the financial crisis, so how will the company be expected to support the robotic machines.

The high cost is required to train workers with robotics, since the robots govern the job in certain places, the labor is needed to support them, so the whole job will not be put into the capacity of the robots, then the employees require training and that includes cost, because a lot of money is involved in building machines in the workplace.

If Robots do not do what they are not meant to do, they can create a lot of electrical waste, the waste created by the robots cannot be used somewhere it is a big disadvantage, Robots can make people idle, which is not good for the business or for the workforce.

Robots have higher costs than humans, they can have AI, but they are not as clever as humans, beyond the pre-defined programming, they do not develop their jobs because they obviously do not think for themselves, Robots deployed in workplaces do need manual labor attached to them, it certainly has a cost to educate certain workers on how to work with the robots.

## 6.3 Dangers of robotics applications:

**6.3.1 Human Errors:** In day-to-day life, human error exists, and this is no different with respect to a robotic operating cell. If it's scripting, proactive maintenance, or teaching suspension control, because of over familiarity or lack of understanding of the motion direction of the robot, operators have the ability to put themselves in risky positions.

**6.3.2 Control Errors:** Errors in the controls software and hardware can lead to hazards inside a robotic work cell. If the system control defects, the system reaction may result in a hazardous operating condition if it is closely related to human activity.

**6.3.3 Unauthorized Access:** Connection to a safeguarded robotic work cell by an unauthorized operator. If an operator is not familiar with the safety hardware associated with the robotic work cell, they can be in an unsafe and potentially lethal environment.

**6.3.4 Mechanical Failures:** Mechanical loss of components is not necessarily taken into account during the design and programming processes. This will escalate to a potentially dangerous situation for the operator when an unintended malfunction happens.

**6.3.5 Environmental Sources:** An adverse impact on a robotic work cell may be generated by outside variables and contact interference. If they are not prepared for during the early stages of the project, unsuppressed power surges or power failure will lead to injuries.

**6.3.6 Power Systems:** It is possible to block power sources that have contact with the robotic cell and contribute to undesired behavior. This will create an energy release, generating a risky atmosphere for an operator.

**6.3.7 Improper Installation:** Whenever an industrial robot is installed, the proper installation of the device until it is completely operational is crucial to the completion of the project and the welfare of the operators. If the robotic work cell is set up improperly, there could be potential dangers due to deviation from the initial configuration.

## 6.4 The Robotics Applications in Automotive Manufacturing:

**6.4.1 Robotic Vision:** A light industrial robotic arm can perform more accurate work with "eyes" so it can "see" what it is doing. The robot wrist has a laser and camera array that provides instant feedback to the computer. When mounting a component, robots will now do proper offsetting, since they know where it goes. Installation of panels for doors, windshields with robotic vision, and fenders are more accurate than normal robot weapons.

**6.4.2 Spot and Arc Welding:** Spot welding on heavy body panels is performed by massive manufacturing robots with long arms and higher payload capability. Lighter elements such as mounts and brackets are welded by smaller robots. On any cycle, robotic tungsten inert gas (TIG) and metal inert gas (MIG) welders will place the torch in the same exact orientation. Due to the repeatable welding specifications, maintaining high welding standards in any development is feasible arc and speed gap.
Collaborative robots on huge assembly lines operate along with other big manufacturing robots. To keep the assembly line running, robotic welders and handlers must cooperate. In order for the welding robot to execute all the programmed welds, robot handlers need to position panels at the exact spot.

**6.4.3 Assembly:** Light robotic arms assemble smaller components such as engines and pumps at high speed in most car assembly plants. Other functions are all conducted by robot weapons, such as screw driving, wheel setting, and windshield construction.

**6.4.4 Painting, Sealing and Coating:** The work of an automobile painter is not an easy one, and booting is very toxic. Labor shortages often make locating experienced, competent painters more difficult.

Robotic arms will fill in the vacuum since each coat of paint needs durability for the job. A programmed course can be taken by robots, continuously covering broad areas and limiting waste. Machines are also useful for adhesive spraying, sealants.

**6.4.5 Machine Tending and Part Transfer:** It is unsafe for human workers to move metal stamps, load and unload CNC devices, and dump molten metal into a smelter. For big industrial robotics, this style of job is fine. For smaller processing processes, system tending and loading/unloading activities are often handled by smaller cobots.

**6.4.6 Materials Removal:** Without failing, robotics will follow a complicated route many times, making it the ideal platform for cutting and trimming work. For this sort of task, light robots with force-sensing technology are better-suited. Tasks include flash trimming from plastic moldings, mold polishing, and fabric cutting.

**6.4.7 Internal Logistics:** Autonomous mobile robots (AMRs) and other autonomous vehicles, such as forklifts, can be used in the industrial environment to move raw materials and other components to the factory floor from storage areas. For example, in Spain, Ford Motor Co. recently adopted Mobile Industrial Robots (MIR) AMRs to supply various robot stations on the factory floor with industrial and welding materials.

## 6.5 The robotics applications in the future:

### 6.5.1 Robotics in public security:

- Artificial crime prediction and detection technologies may seem far-fetched, but the future we're looking at is very realistic. For example, drone footage will soon make that happen. Moreover, for camera-based security systems, automatic detection of suspicious activity is already a reality.
- In a very important way, this technology will change society: it will allow law enforcement officials to respond quickly if suspicious activity has been identified.

### 6.5.2 Robotics in education:

- It is also beginning to blur the distinction between classrooms and individual learning environments. "As Kendra Roberts, an educational expert from Essays. Scholar Advisor, explains, "For every single student in the classroom, a single teacher does not have the potential to fulfill the needs of personalized learning. In this respect, computer-based learning is already changing things. It is not a replacement for the teacher, but it helps students to learn at their own speed.
- The process of personalized learning will be improved by robots. NAO, the robot humanoid, is already forming ties with students from all over the world. It comes with essential senses, like shifting, listening, speaking, and communicating, of natural interaction.

### 6.5.3 Robots at home:

- Cloud-connected home robots are already turning into a part of our lives. we will discover the home appliance to try to the job for America, and that we will prepare a heat home-cooked meal to be prepared by the time we're finished work. Multi-function robotic cookers will, while not our intervention, fry, steam, bake, slow cook, and perform the other action. We're extremely setting them up.
- It is possible that these cloud-linked robots will develop into more advanced models. In the coming years, we expect to see speech comprehension and increased interactions with humans. These developments might end up changing our homes' whole look and feel!

### 6.5.4 Robots as coworkers:

- Robots would have a significant impact on the future workplace. In an organization, they will be able to take on several tasks, so it's time for us to start thinking about how we'll communicate with our new colleagues.
- In terms of voice recognition, robots are likely to grow further, so we can communicate with them by voice commands. This is how Nikolas Badminton expects things to grow in the future: "You're likely to run into associate degree workplace and over the previous few hours your system has been churning considering what is going on in business, your role, your job, what you wish to try to that day, and possibly giving up a couple of thoughts on the proper direction for what to try to."

### 6.5.5 Autonomous cars:

- Some human interference is still needed for self-driving vehicles, but we are getting closer to the day when they won't. The public understanding of this technology has gone from "How is it even possible?" in the past decade. "to "Maybe it's possible..." to "Getting there definitely!"
- Waymo, the business that originated from Google's self-driving car initiative, no longer has a monopoly on this market. Instead, this technology is sought by every important car maker, with Uber being one of the strongest players. When they order the service, the customers of this service will now be paired with a self-driving Uber, so they can get a glimpse of the future.
- Where's this pattern going to take us? We will live to see a new face of public transport by 2020 as businesses continue to invest in this trend.

### 6.5.6 Healthcare robots:

- We're looking for a new healthcare future, too. We'll have intelligent robots doing these activities instead of seeing a primary care physician who can send us a check-up with a simple stethoscope. They will consult with patients, check their situations, and determine the need for more appointments.
- More tremendous improvements will come from pharmaceuticals. They would be like pharmacy ATMs, because we can get the drugs we need while avoiding the hassle of talking about our health conditions with a stranger.

## 6.6 Application of robotics in daily life:

### 6.6.1 Automated Transportation (Self-driving Robot):

- Autonomous self-driving vehicles are seen as the first mainstream, high visibility use of mobile robots. The success of the production of autonomous self-driving vehicles in the last 10 or 15 years is surprising. New cars without robotics are like wheel-based computers. But with robotics, they're more

powerful and free of risk. It's not that selfdriving robots are robots that can drive vehicles. In reality, this implies that cars are built like robots and that cars are implemented with artificial intelligence. The autonomous self-driving vehicle is accessible in a modern world such as in many countries in Europe and America. They're automatic, including buses, trams, trains. But vehicles that run on the streets, including cars, are not very common. But recently, self-driving cars have been launched by Audi, Mercedes and Google. The day is not so far away when there will be no need for human drivers to drive cars. As a consequence, incidents do not happen as much as they do now.

*Fig10. Self-driving robot*

### 6.6.2 Security, Defense, and Surveillance:

- The role of a robot for security, defense, and surveillance is natural. The region needed is surveyed. It alerts the owner immediately if some kind of disruption has occurred. In the military, this sort of robot is used. This kind of robot can be used in everyday human life as well. This kind of robot does different kinds of jobs in the military. They are used to weaponize and disarm explosives. They are sent to the desired area to track the actions of the enemy, which is undoubtedly a dangerous job for the soldiers.

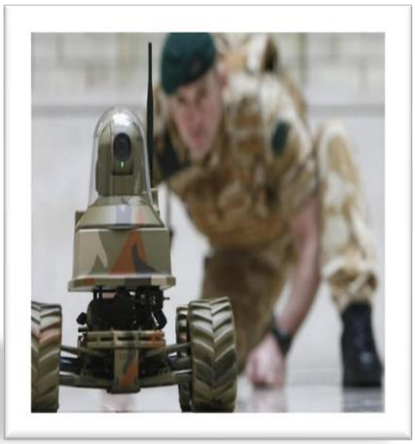

*Fig11. Security robot*

- This form of robot controls the home while individuals are away from their home for use in human everyday life. This robot allows individuals from a remote location to track the skies, land, and water. To track the activities of that site, you can control this form of robot from another location to send it

to your desired location. Thus, if you are not there to track them, you will protect your home and property from being harmed.

### 6.6.3 Robots Cooking:

- It becomes annoying to motivate yourself to prepare an appropriate delicious meal for you when you get home after spending a long working day in the office. Most try to cook the food in a shortcut way, which is often not safe and tasty enough, instead of cooking the meal in a proper traditional way. But how would it be if you had a robotic cooking assistant to make the food as you want it to be?
- There are several programmable robots which, according to your preference, can cook food. All you need to do is set the amount of ingredients in the food. The robot will do the rest. Many robots that can copy you are now being implemented. What you need is just to do the cooking for once in front of the robot.
- Your body's movement is captured by the camera. The robot will copy your acts from then on to make the meal for you. In several hotels and homes, these kinds of robotic cooking assistants are added.
- This kind of robot is made by some firms. Moley Robotics, the Shadow Robot Firms, are very popular among them.

### 6.6.4 Home Maintenance:

- For personal needs, robots are now being made operational. To assist you with household tasks, you can have these robots. Although these robots have not been completely invented like this yet, I assume it will be possible soon. Some examples of having robots at home:

*Fig1 2. Self-assistant robot*

- Home robots are used even if you're not at home to look after household animals.
- It knows when you take showers, meals, and other things. Home robots track you every day. It makes them available before you need them.

- If it's not a house you're in. No stress, there's a robot out there to take care of your house. If there is some noise detected near your house, it warns you.
- Robots will help with laundry, prepare meals, clean kitchens and toilets, and do preparatory work.
- Many robots are able to pick up various items, such as toys, clothing, newspapers. By doing so, it will assist you.
- Some robots can assemble furniture and assist you with heavy object movement.
- Many robots will respond to your phone call now, and are able to continue formal conversation.
- For home repair, there are many tasks that a robot can do. Yet, these kinds of robots are not that available, or they cost a lot if they are available.

# Conclusion

After we talked about robots, their origins, history, and theories related to them, as well as some of their different types and the sciences associated with them - as far as possible - perhaps now dear reader, you ask yourself a very important question, which is what I conclude as a general reader? The simple answer, dear reader, is that you have got acquainted with a topic that was considered mysterious and exciting to you and a topic that carries many question marks that you may have recognized some of them. Before reading this article all you had in mind were those robots that you see in American movies and series such as the Avengers endgame movie or Film Terminator, but I think that your opinion has changed completely after reading this article, which shows you some of the real ideas that were vague to you. In conclusion, I would like to thank you for taking some of your time to read this article, which you will most likely need to know the truth about robots around us.

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