Advanced Robotics and Automation as Modern Approaches to Interaction between Individuals and Computers

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*Abstract---*This paper aims at discussing the future prospect of robotics and automatically handle their transformations. In the contemporary society, these three important innovations highlight the prospects and issues of these technologies in different fields. This paper provides the evolution of robots, various kinds of robots and automation services, and the application of these Robots in manufacturing industry, healthcare and logistics industries. Based on case examples and facts, this article defines trends in human–machine cooperation and their effects on personnel and society in the future.

Keywords—Automation ,Robotics ,Artificial Intelligence ,Ethics , Acceptance

I.INTRODUCTION

- Discuss their current and potential trends.
- Their uses are widely appreciated in industrial usage, in medical facilities as well as in households.
- Give us a picture of the embedded future of the interaction with technology.

A. Background

Robotics and automation have started off as factory instruments to become an essential part in today's society's fabric and the field of health care. Its relevance is rooted in the fact that they can accomplish job tasks accurately, effectively, and without varying a lot from the required standards as might be the case with human personnel. Through this paper, the emergence of these technologies and the role they play in the present-day society is discussed.

B. Problem Statement

First, robotics and automation become more and more essential as these technologies progress, but this leads to a few important questions. These are the consequences for the workforce which sometime may result in loss of job and new skills required for new jobs, consequences for society which includes issues of privacy and ethics, and issues related to technologies that makes the whole system safe and integrated.

C. Objectives

The main objectives of this paper are:
- To outline the advantages and disadvantages of Robotics and automation.

D.Scope of the study

This study focuses on the application of robotics and automation in three main areas: such postgraduate study directions as industrial engineering, medical engineering and home appliances. These includes the critical review of genesis and growth of the various technologies in the chronological perspective, their current state of advancement, and probable future trends in the subsequent sections of this paper.

E. Methodology

This paper employs both the primary and secondary research stratagem that consists of the comparison of a broad range of previous literature and Mechanical and Automated Systems case studies and documentation of Mapping Final pattern. The review includes both empirical and theoretical sources from the academic journals, industry and various cases across different industries.

II. HISTORY OF ROBOTICS AND AUTOMATION

A. Early development

Robotics and automation are defined as the designing, construction, and operation of robots and automated

machines Robotics and automation date back to ancient civilizations that had most primitive types of the aforementioned inventions. But the new movement of robotics was initiated in the twentieth century. The creation of Industrial Robot 1 Unimate in the 1960 by George Dovell and Joseph Engelberger opened the way. Unimate was employed in activities such as welding and assembling a car in a GM production line to show the capability of robots in changing manufacturing .
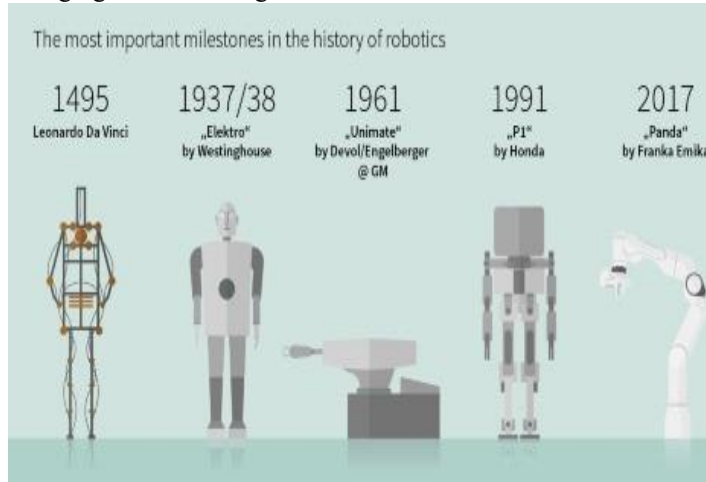

Fig:1 Development in design of Robots over time.

B. Technological progress

Science has advanced within the area of engineering and produced robotics as well as automation. The advancement of the industrial revolution in 1970s made it possible for people to design and produce more enhanced robots that are capable of complicated activities. With the help of CAD (Computer Aided Design), CAM (Computer Aided Manufacturing) technologies the possibilities of industrial robots extended. Since the third millennium there has appeared trend of cobot – robots working together with people; appearance of artificial intelligence, machine learning and other opportunities that widened the range of problems and robots can solve independently.

C. Impact on Industries

Robotics and automation has had a big impact on many companies and organizations. On the production side there has been improvement of efficiency and cutting down on the costs while the quality of the products has improved. Robotic surgery has been brought in the medical industry and has provided the highly precise and minimally invasive operations. Selection has also undergone remarkable transformation in that automated warehouses and automated delivery systems have emerged. These technologies have not only helped in increasing efficiency and productivity but also in the creation of new business models and he services.

III. CLASSIFICATION OF ROBOTS AND AUTOMATION SYSTEMS

A. Industrial robots

 The majority of used industrial robots are employed in the production line. It is designed for such tasks where block

repetitive, precise task that would otherwise be tiresome for a man to perform such as gluing, painting and assembling. These robots can be grouped in line with their structure and operations as the articulating robots, Scara Robots, Cartesian Robots, as well as the cylindrical Robots. Articulated robots are very versatile owing to the many joints and are commonly used in the assembly lines of vehicles. If there are fast and precise movement, then SCARA robots well suited for pick and handle jobs.

Fig: 2 Programmed robotics Arms Engaged in manufacturing activities.

B.Service robots

 Like industrial robots, service robots are not meant for manufacture; however, they are intended for non-production services, and most commonly interact with people. It is employed in several facilities such as those dealing with health, accommodation and residential purposes. Da Vinci is an example of a robot used in surgical operations while other robots are used to help in patient treatment and or recovery. Domestic end-use products like robotic washing machines and many more are increasingly being adopted in homes and they have the added advantage of doing away with much of human effort.

C.Autonomous Vehicles

 Chimeras such as self-driving cars and, indeed, drones are some of the significant innovations in automation and automation. These are vehicles that are guided and that perform most tasks with the help of sensors, cameras, and artificial intelligence wither no input from a human driver. , autonomous vehicles can potentially infuse traffic by minimizing accidents as well as enhancing the volume of vehicular traffic. The use of drones is in different sectors, including photography, monitoring and surveillance, delivery, security and policing.

D.Automation Systems

 Depending on the level of adaptability of the automation system and practical application, there are the subgroups of fixed automation, programmable and flexible automation. Probably the best definition of true automation is where the production processes involved are cyclic, repetitive, massive production lines, including assembly lines. Program automation can be used in a modular way so that different programs can be used for making different parts of the product. They achieve a very high degree of flexibility

which enable changes to be made quickly to the process to suit the market and it is a very good setting for custom manufacturing ..

IV. APPLICATIONS OF ROBOTICS AND AUTOMATION:

A. Manufacturing & Healthcare

Automations and Robotics is changing the industries such as manufacturing and health care industries through increased efficiency, increased accuracy and safety. In manufacturing, robotics has introduced effectiveness in production, where firms can produce more products with less manufacturing errors. Numerical controlled tools, for example, assembly line, welding and packaging among others can be best handled by automatic robotic system as they do not require a lot of supervision and have very little defects as compared to human beings. This not only enlarges the production efficiency but also enables the manufacture of the products which are beyond the capacity of human precision. In addition, the usage of robotics in manufacturing extends to technology such as artificial intelligence AI, and machine learning to enable the systems to learn and improve hence attaining optimum functionality in real-time. This is essential for industries experiencing high demand with a requirement of customization.

Similarly, in health care, robotics and automation deliver the identical impacts. Surgical assistants, for instance, let operations to be performed via a less invasive approach, making recovery faster and with lesser risks of a complication. These robots help surgeons in offering fine motor control and huge sensitivity that can facilitate complex surgery that is almost impossible to perform personally. Other than operation, others are utilized in rehabilitation whereby they assist patients recover from immobility through exercises. Technology is also applied to the management of hospital's materials or supplies, such as automated dispensing systems for medication, and robotic transportation of material and equipment. This cuts down the burden of work on health care staff so that they have adequate time to attend to the patients. In like manner, applications of robotics interrelated to health care are leading to remote operations and tele-surgery that touch on scenarios whereby surgeries can be conducted under varying, extended distances, and opening up of further opportunities on quality delivery of operations in regions that are hard to reach. Robotics and automation are still improving in application here, with more advancements in store that are set to revolutionize the manner in which manufacturing and healthcare industries run their operations.

B. Agriculture, Military & Defence, Domestic use

Robotics and automation have gone to the agricultural sector, the military and defense, as well as household use, to drive enhanced efficiency, safety, and productivity. In that role, drones scan fields for indicators of plant health, and self-driving tractors and combining equipment plant and harvest with precision. Besides increasing production and reducing costs, this automation optimises the natural way of farming as no chemicals are used and minimum contact with the ground is made.

Military and defense is one of the bureaucracies that reap maximum benefits from robotics because it improves the working capacity while reducing the personnel at risky areas. UAVs as relates to surveillance, reconnaissance and selective delicate assault provide real time information. Explosive ordnance disposal, handling of bombs, and armed forces are some of the applications where ground-based robots are indispensable autonomous ground vehicle is used in logistics applications in harsh terrains. Complex robotic facilities are also used in defensive tactics making them articulated and highly accurate in its operations.

Robotics and automation are also applied in domestic environments and reduce time for most activities and enhance the life of the people. General purpose robots such as cleaning robots for homes like the vacuum cleaning robot and the lawn mowing robot perform chores and tasks on their own while smart homes which encompass a variety of home systems offer users easy and centralized control of aspects such as lighting, climate, security, and home appliances. These systems adapt to the users with an improvement on the energy use and ease. Furthermore, social care robots for elder and companion-centered assist and care elderly and disabled people by providing medication alerts and help them to move around.

These technologies, thus, holds defaults for steady and progressive improvement of Agriculture, Military & Defense, Domestic Use and many other in the coming future.

V. IMPACT OF SOCIETY AND THE WORKFORCE

A. Job displacement vs Job creation:

The deployment of robots and automation are place center stage in a matrix of a contentious discussion on unemployment and employment generation, ethics and ramifications on robotics and its social and economic impact scopes. On one side they are opposed to the idea of automation because it threatens to take away their jobs and those of others since automating is easy in repetitive monotonous jobs that are common in factories and shops. This results in massive lay-off especially on individuals with low skill, which in turn intensifies income and economic differential. But yet while some jobs are replaced, there are other new occupations such as maintenance of robots, programmers of the robots and even developers of the AI. This shift invariably calls for skills upgrading by the workers thus the importance of having strong retraining programs to help workers displaced by the change make a transition as skilled workers.

B. Ethical Considerations:

From an ethical perspective, these technological transitions are questionable, or at least questionable with regards to the fairness of such transitions, and the social obligations concerning those who are impacted. These are for instance the issues of automation deepening discriminative dispositions that are already present in the sociopolitical

system to include discrimination in hiring and in police force.

C. Social and Economic Impacts:

Looking in the social and economical both the effects of robotics and automation are large. AI can make processes more efficient and even cheaper in terms of a business's expenses and needs – but not all of those savings will be shared proportionately. Profits resulting from the use of automation are likely to be accumulated by the owners of the machines in question, and thus may lead to the reinforcement of the social divide between the 'haves and the 'have nots. On the other hand if there is a good management in the integration of robotics it brings other benefits to the society such as more leisure time and quality improvement of life. The difficult part arises when the people responsible for making the appropriate policies and systems of automation have to be found so that there is parity in the benefits accumulated from the troubled effects which accompanies the positive effects of automation.
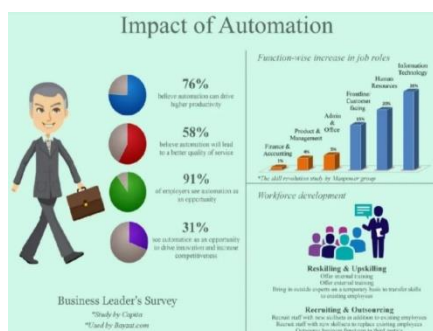

Fig: 3 Ethical Impact of Robotics and Automation in Industry.

VI. CHALLENGES AND LIMITATIONS

A. Technical Challenges:

Robotics and automation for instance have some technical barriers that hampers their growth and implementation. A main problem is developing robots that can function in similar fashion and not in pre-defined structured spaces. High-reliable robots can be designed for factory environments and cannot cope well with random and dynamic environments like homes or fields which call for higher end sensors, AI and algorithms. For example, robots have to learn how to avoid obstacles, identify the objects in front of them and learn how to react to changes in their environment, something that has not been easy to attain in robots.

One of the current problems is the creation of robotic hands and mastering of the precise motor movement. Processes often exceed the current capabilities of robotics in areas where there is a necessity of fine and detailed work, for instance when handling delicate artefacts or conducting delicate operations in surgery. This limitation makes it necessary to get the assistance of humans, which decreases the effectiveness of automation to a great extent.

Also, guaranteeing the dependability and safety of robotic systems are mandatory, especially for strictly controlled purposes, such as treatment and transports or driving. Malfunction or errors in these areas are presaged to lead to severe consequences that is why testing and validation processes are considered to be necessary while being at the same time time-consuming and costly.

Furthermore, the quick developments in the technology create a problem, owing to the fact that new robotic systems can deprecate quickly hence leading to the need to invest in improvements and other improved technologies. This brings an element of financial cost especially that, many small and medium enterprises are directly involved.

It is important to note that in overcoming these technical challenges lies the future of robotics and automation across certain industries and that will always demand more ideas and financial commitment in the research department.

B. Ethical and Legal Challenges:

Robotics and Automation is one of the economic systems that has huge ethical and legal implications which require urgent intervention to guarantee responsible application. Another elastic lie is a lie to fulfill an ethical need, and one of the primary ethical needs is job protection or job security. With the help of robotics and other automated systems, human beings are at the risk of losing their occupations; more so, repetitive and low-skilled occupations. This calls for issues of social corporate responsibility to the displaced workers and probably the necessity of retraining.

One of the ethical consideration is that Machine Learning system can be prejudiced. If the data that is fed into these systems is unbiased, the decisions made – in hiring, policing, or treatment – will reinforce discrimination and prejudice. To avoid such outcomes, it is therefore imperative that transparency and fairness in the artificial intelligence algorithms being used be upheld.

In the legal aspect, it is crucial to refer that the process of robotic technology evolution is far beyond the creation of the applicable laws and regulations. Questions around liability are particularly complex: in case an autonomous robot inflicts an injury, identifying who is answerable, whether it be the producer or programmer or the user, is complex. Besides, deficiencies in data privacy are witnessed when robots accumulate large amounts of the public's data, making data protection laws strict.

It is important to address the following ethical and legal issues for realization of robotics and automation technology for improvement of the society without regarding the human rights and societal values.

C. Economics Barriers:

Lack of economical resources is another crucial factor that makes the spread of robotics and automation a problem. This includes the capital outlay costs in procuring and integrating new lines of production with robotic systems which are very expensive, more so to SMEs. Such costs also involve casing and extent to which the software it has to

incorporate may call for extra unique solutions, costly and time-consuming even.

Also, it is also realized that due to the fast-growing rate in the advancement of systems, the systems can quickly become outdated and thus the organization may need constantly to put more capital in top-of-the-range systems. This generates financial risk, especially in targeting several classes, for companies with low budgets. Besides, the given by automation, including productivity gains and lower costs of labor, may take their time to accrue and thus the value accruing from the investment is unknown. For this reason, these economic factors are a hindrance to the implementation of robotic technology to most firms since it hampers their ability to effectively integrate robots and automation to their operations in the course of advancing to more mechanized industries.

D. Social Acceptance:

Technological acceptance by the social society is another aspect that determine the extent to which robotic and automation will be adopted. Nevertheless, there is a great deal of public concern and even fear of these technologies. It is common to hear people arguing that robots will steal people's jobs, making the latter unemployed and fostering economic injustice. This fear is especially felt, especially in industries that are viewed to be at the receiving end of automation which include manufacturing and retail. However, existing diminutive discussions and emerging robotic technology issues raise questions on privacy and control in areas where robotic technology has penetrated deep into working and living human areas. The population is concerned with cases of misuse of data which robots collect and the reduced human interventions on decisions some robotic systems take, especially those that apply artificial intelligence. In order to eliminate these concerns, it is necessary to incorporate the public in the matters concerning the advantages and disadvantages of robotizing and automating the workforce. The use of such technologies should, therefore, be made clear to the public together with the understanding that they enhance rather than compete with employment. Policies that are protective of labour, privacy, and wholesome usage of AI are other ways to create trust. Social acceptance will ultimately be determined by how well these issues will have been tackled to make robotics & automation look like part of the human life improvement process rather than a threat.

VII. ROBOTICS AND AUTOMATION CONCEPTS OVER THE YEARS

A. AI and Machine Learning

AI and ML are mindfully directed towards building systems and system that can favor in tasks that need human intelligence.
AI relates the border concept of making or building machines or creating software which accomplishes the work that would normally be done by the analysis of human brain.

ML exist as a branch of AI, which involves the use of algorithms to enable it remember the pattern and make subsequent decisions from the data.
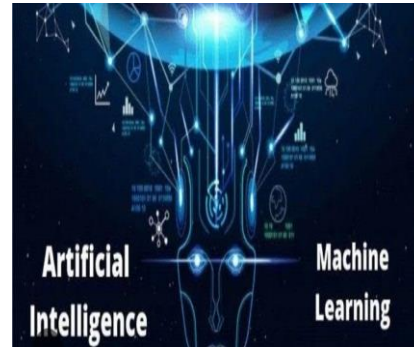

Fig:4 Artificial Intelligence and machine Learning

B. Human-Robot Collaboration

Human-robot collaboration is set to merge significantly in future, directed by advancement in technology, and high demand for more dynamic media experience like Human-robot collaboration is set to merge significantly in future, directed by advancement in technology, and high demand for more dynamic media experience like :
1. Enhanced interaction capabilities
2. Collaborative creative processes
3. Machine learning and AI augmentation
4. Real-Time Feedback and modification
5. PT: Integrate the virtual and the artificial realty
6. Improve complexity

Fig: 5 This Picture shows the collaboration of robots and Humans to fulfill tasks.

C. Internet of Things (IOT) and Robotics

IOT and Robotics has the broader ability to reshape many aspects of life and many sectors of the economy in the future. Some possibilities are
1. Healthcare Advances
2. Smart homes and cities
3. Data Implement and analysis
4. Agricultural Innovation
5. Industrial Mechanization
6. Enhanced Human-Robot interaction
In general, both IOT and robotics produce more intelligence and efficient through a number of domains.

D. The concept of ethical al and responsible

Automation

Ethical Al and Responsible Automation are determining for the future to make sure that technological advancements welfare society while prevent harm like :Ethical Al and Responsible Automation are determining for the future to make sure that technological advancements welfare society while prevent harm like :

Randomness and prejudice, openness, responsibility, data confidentiality, stability and protection, human control, lawful usage.

As technology upgrade, serial dialogue and regulatory structure work will be needed to do these guide .

E. Sustainable Robotics

Sustainable robotics in the future is similar to focus on some points Sustainable robotics in the future is similar to focus on some points

1. Eco-Friendly materials
2. Energy efficiency
3. Circular Economy
4. Smart manufacturing
5. Ethical Consideration
6. Longevity and Maintenance

These developments will be help robotics to achieve structure objectives of minimizing impacts on the environment and embrace sustainable development.

VIII. CASE STUDIES

A. Successful Implementation in industry

Successful implementation depends on some points like Successful implementation depends on some points like

1. Clear Objectives
2. Planning
3. Resource Allocation
4. Stake holder Engagement
5. Training and Support
6. Monitoring and Evaluation
7. Risk Management
8. Communication

Industry, economy, medicine, agriculture, military, and even homes have seen the impact of robotics and automation. These technologies have a multitude of benefits, productivity, accuracy, and safety, not to mention that tasks that were never before possible or only possible at a high cost now can be done. But, they also have issues; issues relating to job displacement, ethical issues and technical issues. These questions, therefore, have to be answered to when formulating policies to address the social integration of this technology since it is anticipated to become more integrated in the course of our evolvement as a society to have a proactive approach to meeting the challenges arising from the automation of activities that were traditionally handled by people. Robotics and especially automation, as the main part of the Fourth Industrial Revolution, represents important potential for further upliftment of human capacities and lives' quality if only that increase will be achieved by the right and moral use of Robotics and

Fig:6 AI and ML Play an essential in Development of smart Homes.

By so doing, organisation can ensure that they demonstrate they are capable of achieving efficiency and implementation of a unique outcome.

B. Lessons from Failures

If we face failure, then we can consider some point to improve this like :If we face failure, then we can consider some point to improve this like :

1. Resilience and Adaptation
2. Critical Reflection
3. Innovation and Creativity
4. Skill Development
5. Feedback and Improvement
6. Risk Management
7. Emotional and psychological Impact

If we skill such terms we are able to superb the skills and avoid failure at further evidence.

IX. CONCLUSION

automation systems. If society manages to overcome the obstacles and take greatest advantage of the opportunities which are provided by the further development of robotics and automatization, the position of individuals and the society in general will only benefit.

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