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Technoarete Transactions on Industrial Robotics and Automation Systems

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A Robotic Manipulator's Design and Performance Using in Casting Industry to Manage a Shell Adapter

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A B S T R A C T

The original objective of creating a robotic gripper has been revised. A new approach has been suggested and sanctioned for designing a robotic arm. The methodology involves the gradual construction of prototypes for mechanical arms. The optimization process integrated into the methodology guarantees the successful development of the robotic arm. Identifying the hand application serves as the primary step in defining the parameters and prerequisites for the subsequent phase in the design process. The incorporation of human hand research plays an essential role in devising anthropomorphic architectures as it showcases their versatility, flexibility, and manipulation capabilities. The decisive goal of this method is to formulate successful robotic arm architectures and systems that meet the design proposals' requirements.

Keywords:Grippers, Manipulator, Robot Arm, Right Gears, Wrist.

INTRODUCTION

A robotic gripper must be versatile and capable of performing reliable grips and manipulations in unstructured environments, for example. The high cost and excessive layout complexity prevent robotic grippers from penetrating the product. To alleviate these limitations, researchers have proposed a low-power robotic gripper with a tendon drive mechanism (TDM). budget. However, designing a robotic gripper is a very complex method involving many parameterized simulations. Automation systems use robotic grippers as one of their main components. The pick-up module allows the robot to pick up, move, and place objects to pick, transport, and place workpieces. Robotic arms usually have sensors mounted near the workpiece. A wide range of tasks can be performed using automation components such as robotic arms and software. This allows the production of multiple product variants. Conversely, capture modules are often customized for specific tasks and come with tools to aid in customization.

LITERATURE REVIEW

The capability of selecting and grasping microscopic objects with a pneumatically actuated microgripper that can provide tactile feedback was tested by Alogla et al. Their experiment involved testing a device that has a maximum tip opening amplitude of 1 mm, and a maximum force of 50 MN. Additionally, the device was tested to perform pick-and-place operations with 200 µm microspheres [1]. Huixu Dong et al developed a mathematical model to determine the efficiency of transmitting tension force when using geometrical relationships. A Genetic Algorithm is used to optimize gripper and tendon routes [2].

Matteo Russo et al focused the design of a gripper for horticulture product grasping. Design decisions were made using a systematic method using an evaluation of all possible architectures. Prototypes were built and tested in the laboratory [3].

Alaa Hassan et al. proposed methods for modeling robots and optimizing their structures. They provide a comprehensive step-by-step demonstration of their design methodology and conduct dedicated capture studies to describe the interactions between those steps. Their goal is to determine the optimal force developed by a robotic gripper at the bottom of a captured solid object under geometric and functional constraints [4].

Bos et al. developed a lightweight suction grip. In the microcosm, assembly issues related to forces were mentioned. A gripper design with a delivery mass of less than 1 g is proposed for needles with a diameter of 6 mm with a delivery mass of less than 1 g [5].

Anurag Singh et al analyzed and investigated the stresses and strains caused by selected payloads. A mechanism arm with 5 degrees of freedom was selected for stress and strain analysis [6].

The remaining sections of the paper are arranged as follows: Chapter 2 covers recommended models and optimal approaches for robot designing. Section 3 outlines the experimental design for the robotic gripper and includes a review of the geometric modeling. Following the description and modeling of the gripper and corresponding design calculations, Section 4 explores the results. Lastly, Section 5 provides a summary of the findings presented in this article.

METHODS

According to Figure 1, the product design process consists of five sequential steps

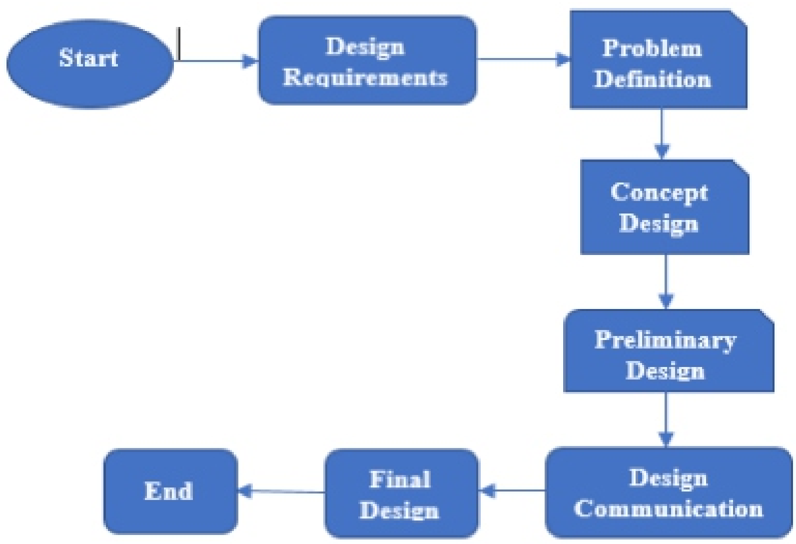

Figure 1. Design Process of a Product

The product design process is made up of five sequential steps, as shown in Figure 1. The first step involves identifying design problems and clarifying the design's purpose. This leads to the definition of requirements. During the concept draft stage, specifications and design preferences are established, and alternatives are modeled, analyzed, and evaluated. These options can be exported at a later stage. The element design stage focuses on defining design details to create manufacturing specifications for an optimized design. Finally, design implications follow a detailed description of the final design and its characteristics.

DESIGN OF EXPERIMENTS

The accurate handling of the shell adapter depends on the design of the robotic manipulator. The manipulator has multiple components, including the arm, end effector, and control system. The arm helps with the necessary movement and positioning needed to handle the shell adapter, while the end effector holds onto and releases the adapter. The robot's gripper is made up of four main parts: wrist, base, nails or fingers, and Earth, and has two degrees of freedom. This component connects the robot's gripper and arm.

Wrist

The wrist enables twisting of the handle and has three components - two connected parts and one that connects to the rotation axis of the servo motor. Other details aid in transmitting movement across the wrist, which is connected to the handle base and floor. Figure 2 displays the wrist assembly with an additional connector for the base and hook at a 90° angle to the horizontal axis. It has three holes for connection, an outward step for gear insertion, and three more holes for other parts. Precise calculation of element spacing is crucial for the mechanism to function correctly.

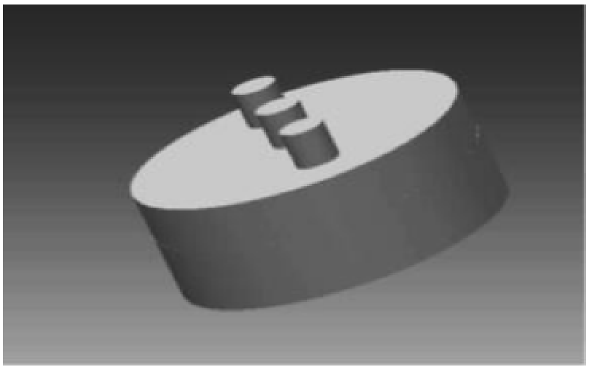

Figure 2. Assembly of Wrist

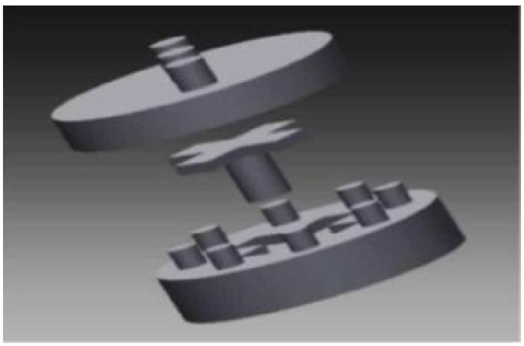

Figure 3. Exploded view of the Wrist.

We will also use another connector that will be part of the base and hook whenever we hold the hook at a 90º angle to the horizontal axis. In the image, we can see three holes to connect the wrist, an outgoing step to insert the gears, and three other holes that have the function of connecting other parts. This is the hardest part because all the parts are connected. The distances of these elements must be accurately calculated to obtain accurate operation of the entire mechanism. Several important aspects must be considered when designing this element.

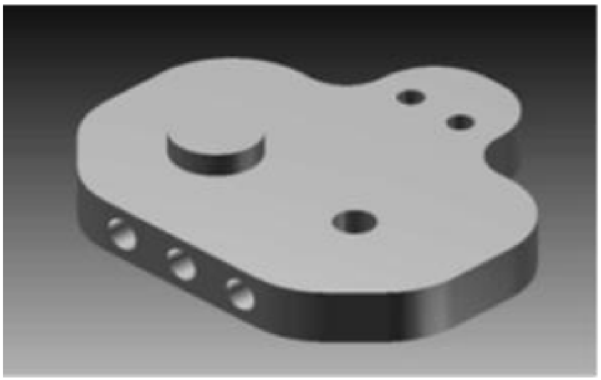

Figure 4. Base

The base links the robot handle parts and has two gears attached, with one connected to another servo motor via a linkage to provide gear movement and handle motion.

Grippers or Fingers

The handle, which can come in various shapes and materials, is capable of holding items with differing contours and weights. It should be noted that there will be a movement of translation. The gripper serves as the final component, and the function of each part (including the servo motor, clutch, and gear) culminates in its action. The design of the handle allows for a secure grip on even the thinnest objects, and holes found in planes are utilized to connect the gears and handles

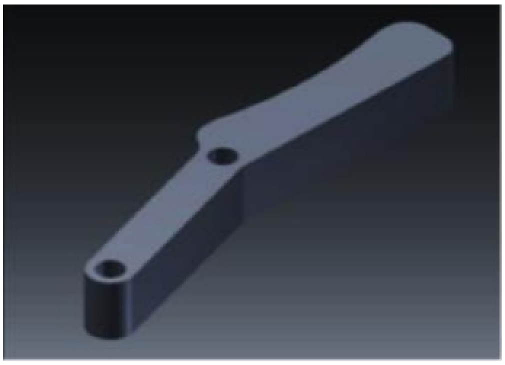

Figure 5. Gripper

Earth

The earth is responsible for holding the servo motor that moves the wrist, making it a crucial component. If this part malfunctions, the grip's behavior will become unstable. Additionally, this part attaches the entire robot handle to an already existing robot arm.

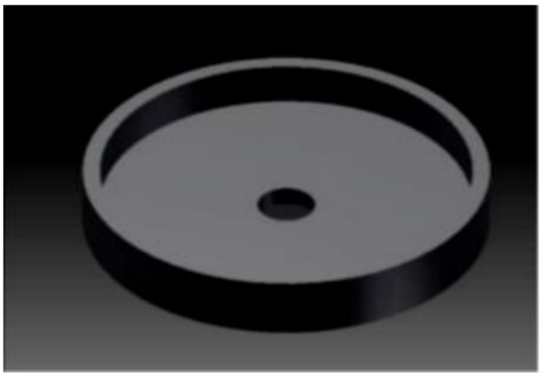

Figure 6. Earth

Calculation of Force on Gripper

This section will compute the gripper's force. The robot's gripping moment will produce forces, resulting in three claw positions: minimum nail opening, middle nail opening, and maximum opening. First, the torque-generated force must be calculated. This force should be perpendicular to the radius of gyration and denoted as F. The torque formula is also necessary.

Least Aperture

First, we need to calculate the force produced by the torque. This force must be perpendicular to the turning radius and this force is called F. The torque formula is:

$$T = F \cdot r \quad (1)$$

Having obtained the servo motor information, we can determine that the torque is equal to 0.078Nm or 78Nmm. The distance between each point can be measured, as well as the radial distance r, which is equal to 51.72 mm. By utilizing the formula $F = T/r$, we can calculate the force, which is equal to 1.5075 N. However, since this force is not directly applied to the handle, we need to calculate the F1 component using the following formula after measuring the angle α using the Autodesk program inventor:

$$F1 = F * \cos(\alpha).$$

$$F1 = F \text{ Cos } (\alpha) \text{ where } \alpha \text{ is } 69.78° \text{ and}$$

$$F1 = 1.5075 \text{ Cos } (69.78) = 0.521 \text{ N}$$

Now we need to solve a system containing two equations and two unknowns. The first equation is After obtaining information about the servo motor, we can deduce that the torque equals 0.078Nm or 78Nmm. We can measure the distance between each point and the radial distance r, which is 51.72 mm. Using the formula $F = T/r$, we can determine that the force is 1.5075 N.However, this force isn't directly applied to the handle, so we must calculate the F1 component using the following formula:

$$F1 = F * \cos(\alpha).$$

After measuring the angle α using the Autodesk program Inventor, where α is 69.78° and

$F1 = F * \cos(\alpha)$ (2)

we can calculate that F1 equals 0.521 N. We need to solve a system containing two equations and two unknowns. The first equation is

$\Sigma Fx = 0$

$- F1 \cdot \cos(\alpha + \beta) - F2 \cdot \cos(\varphi) + Fgripper = 0$ (3)

Where $\beta = 3.64^o$ and $\varphi = 86.36^o$, so:

$Fgripper = 0.521 \cdot \cos(73.42) + F2 \cdot \cos(86.36)$

The second equation is:

$\Sigma Fy = 0 \; F1 \cdot \sin(\alpha + \beta) - F2 \sin(\varphi) = 0$

$F2 = F1 \sin(\alpha + \beta) / \sin(\varphi) = 0.5003$ N

Fgripper = 0.1804 N

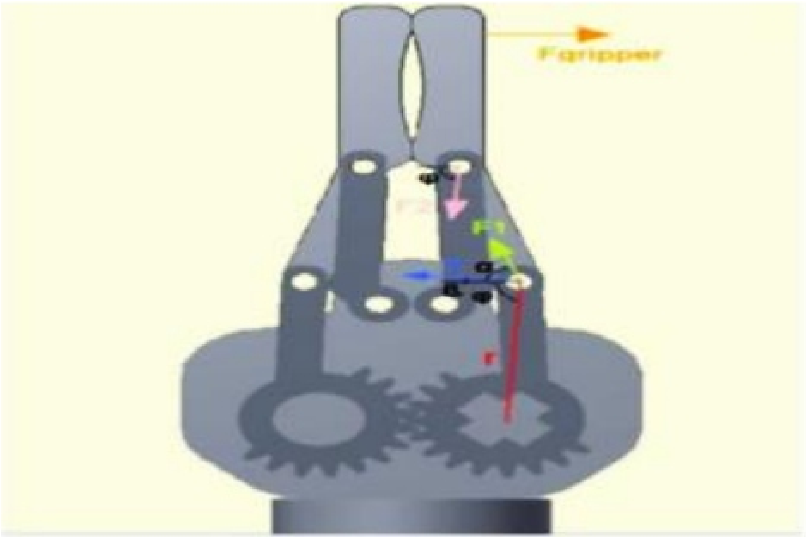

Figure 7. Least Aperture

Standard Aperture

Perform the identical task, yet execute it in the manner illustrated in Figure 8. The force's orientation is inverted, and as such, the angle and force quantities differ. Nonetheless, the force factor F persists as constant and solely hinges on the torque's magnitude and the radius of the gyration's value.

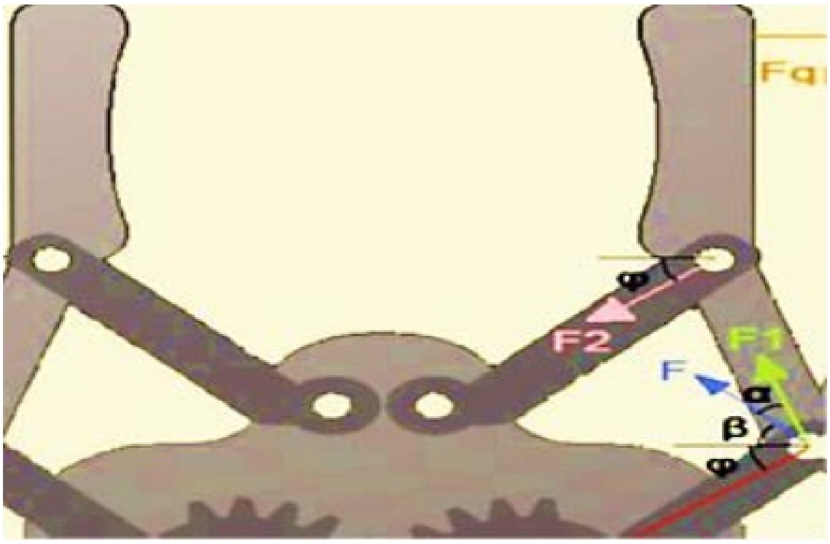

Figure 8. Standard Aperture

F1 = 1.3901 N

In this case, $\beta = 50.55^{o}$ and $\varphi = 39.45^{o}$,

$Fgripper = 1.3901 \cdot Cos(73.31) + F2 \cdot Cos(39.45) = 2.0174$ N

F2 = 2.0956 N

Extreme Aperture

Figure 9 displays the extreme aperture, where β is 73.28°, φ is 16.72°, and the gripping force is 5.2399 N. The gripper's force augments with larger nail openings. In the casting industry, the robotic manipulator's efficiency is critical for managing the shell adapter. Accuracy, precision, and speed are used to evaluate the manipulator's effectiveness. The new gripper design features improved grips, additional rivets, and a round handle for easy 3D printing. The small distance between the handles makes it an optimal design. The gripper assembly is both visually appealing and efficient in performance.

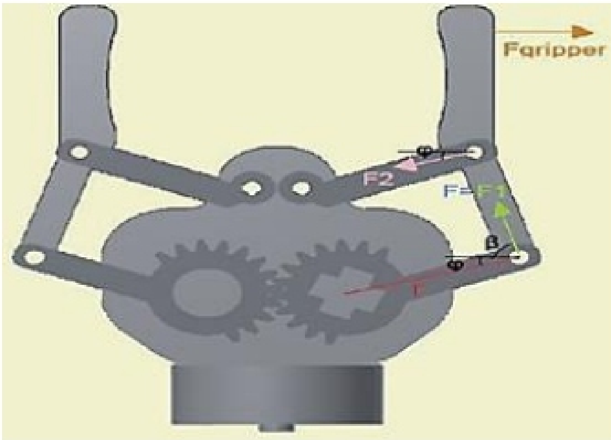

Figure 9. Extreme Aperture

Fgripper = 1.5075 cos (73.28) F2 cos (16.72) = 5.2399 N F2 = 5.018N

The size of the nail opening correlates with the amount of force needed from the gripper.

RESULT & DICUSSION

The performance of the robotic manipulator in the casting industry is critical in ensuring that the shell adapter is managed effectively. The robotic manipulator is programmed to perform specific tasks, including gripping and releasing the shell adapter, rotating the shell adapter, and moving the shell adapter to the desired location. The manipulator's performance is measured based on its accuracy, precision, and speed. In developing the product, we experimented with different designs and finally found the most effective grip.

The grip has been enhanced to reduce the minimum distance between the components and fasten them together with rivets. Additionally, the clips have been rounded for simpler 3D printing. This design is optimal due to the minimal distance between the handles. We evaluated various models and determined this to be the most suitable. It should be noted that studs are exclusively utilized for modeling, while rods are employed when producing a clip.

First Design of the Gripper

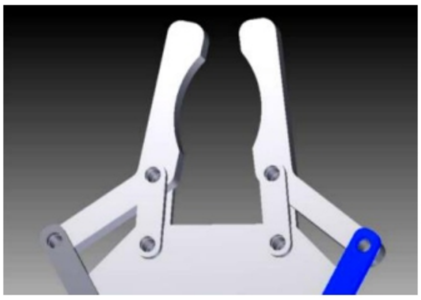

Figure 10. The first design of the Gripper

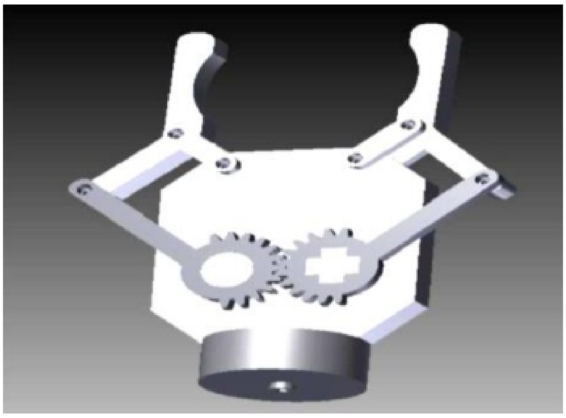

Figure 11. Appreciate the Rotation's Problem.

Figure 11 depicts rotational issues that need identification. The design was abandoned because of excessive material usage. The gripping action was slightly modified. The image displays the misalignment of the steering wheel, which is the result of the gear's turning radius rotation caused by the different turning radii of the base and crank. This required adding a single connector with the same radius as the gear to modify the multinational robotic arm.

Second Design of the Gripper

Figure 12. Second Design of the Gripper

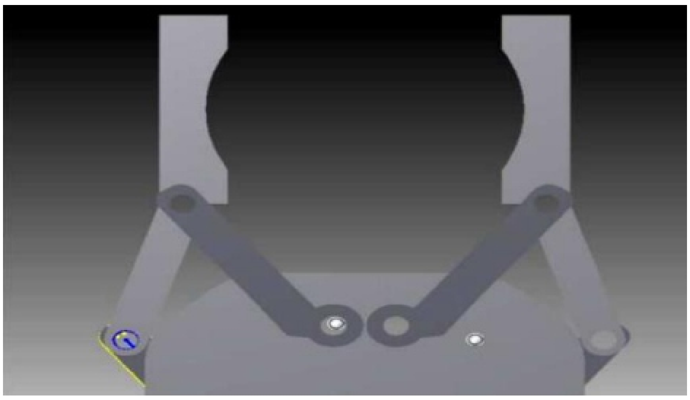

Figure 13. Width of the Base

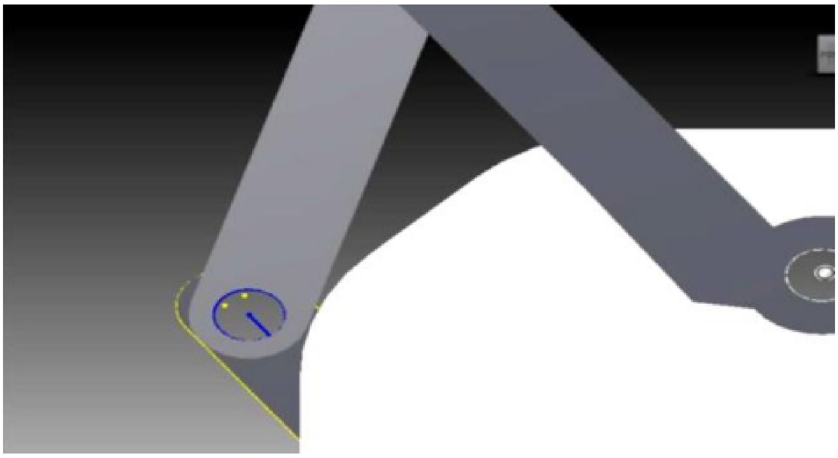

Figure 14. Collisions of the Gripper and Base

The collision between the claw and the base was resolved, and the team proceeded to enhance the efficiency of the robotic gripper whilst minimizing material usage. Nevertheless, the broad top of the base causes the handle to strike prematurely, resulting in a significant minimum opening of the robot. The poor quality of the recording is attributed to the gadget's ability to only detect very large objects.

Third Design of the Gripper

Figure 15. Third Design of the Gripper.

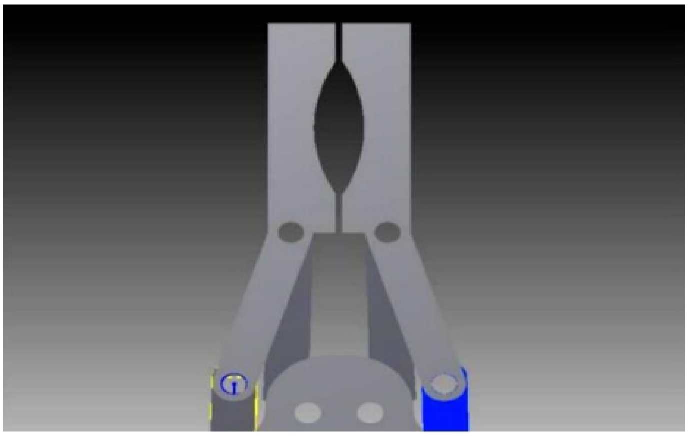

Figure 16. Minimum Aperture of the Gripper

Collisions between the claw and base took place. After resolving the rotation problem, the robotic gripper was redesigned to improve efficiency and reduce material consumption. However, the broad upper part of the base caused early contact with the handle, resulting in a considerable minimum opening of the robot. The recording quality is not optimal because only large objects can be detected.

Final Design of the Gripper

Figure 17. Final Design of the Gripper.

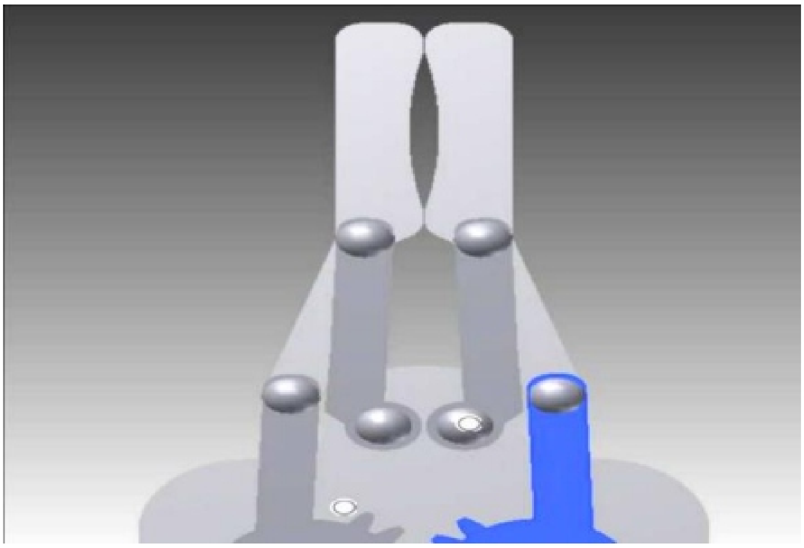

Figure 18. Minimum Aperture of the Final Design of the Gripper

The design of the final gripper features a minimum opening, which is illustrated in Figure 18. The grips have been enhanced to reduce the gap between them and rivets have been incorporated to connect all the pieces together. Moreover, the round handle is conducive to 3D printing. This design is highly optimal as it minimizes the distance between the handles. We conducted a comprehensive evaluation of multiple designs and eventually selected the best one. Please note that the rivets are solely employed for modeling purposes and the rod should be utilized when creating the handle.

The Gripper's Assembly

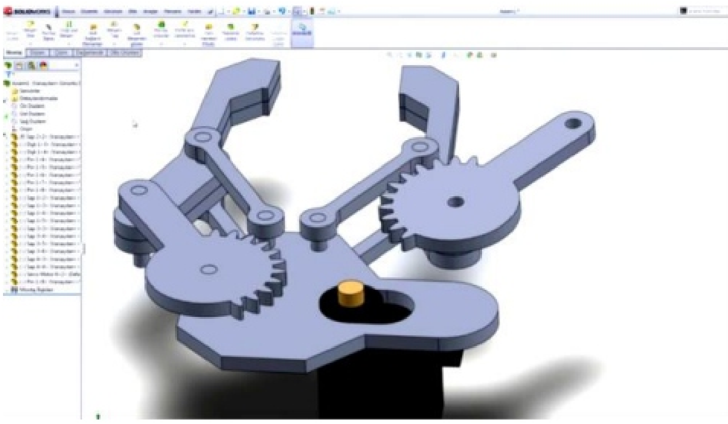

Figure 19. Gripper's Assembly

The gripper assembly, which includes all the previously mentioned parts, is shown in Figure 19. The overall appearance of the assembly is both pleasing and acceptable.

CONCLUSION

The task of creating a robotic gripper has been altered and a fresh approach for designing a robotic arm has been sanctioned. The process involves the production of various prototypes of the mechanical arm in a constant way. To make sure that the methodology is successful, the optimization cycle is carried out. The first step is to determine the intended hand application which sets the parameters and requirements for the consequent design phase. Research on the human hand is crucial to develop anthropomorphic architectures that have adaptability, flexibility, and manipulation abilities. The primary objective of this methodology is to manufacture robotic arm systems that fulfill the design proposal requirements. The use of robotic manipulators in the casting industry to supervise shell adapters has revolutionized the casting process. The design and performance of the manipulators ensure that the shell adapter is handled with precision and accuracy, thereby resulting in a better-quality end product. The advantages of using robotic manipulators in the casting industry are countless as they improve the speed, efficiency, and safety of the casting process. With technology continuously advancing, we can look forward to observing more innovations in the casting industry that will further upgrade the process.

Acknowledgements

I am grateful to all of those with whom I have had the pleasure to work during this and other related projects. Each of the members of my article has provided me with extensive personal and professional guidance and taught me a great deal about both scientific research and life in general.

REFERENCES

[1] A. F. Alogla, F. Amalou, C. Balmer, P. Scanlan, W. Shu and R. L. Reuben, 2015, Micro-Tweezers: Design, Fabrication, Simulation, and Testing of a Pneumatically Actuated Micro-Gripper for Micromanipulation and Micro tactile Sensing, Sens. Actuators A: Phys,.236 (1), 394-404.

[2] Alaa Hassan, and Mouhammad Abomoharam, 2017, Modeling and design optimization of a robot gripper mechanism, Robotics and Computer-Integrated Manufacturing, 46 (10, 94-103.

[3] Dalibor Petković, Nenad D. Pavlović, and Žarko Ćojbašić, 2013, Adaptive neuro-fuzzy estimation of underactuated robotic gripper contact forces, Expert Systems with Applications,40 (1), 281-286.

[4] Huixu Dong, Ehsan Asadi Chen QiuJiansheng DaiI-Ming Chen, 2018, Geometric design optimization of an under-actuated tendon-driven robotic gripper, Robotics and Computer-Integrated Manufacturing, 50 (1), 80-89.

[5] Lionel Birglen, Thomas Schlicht, 2017, A statistical review of industrial robotic grippers, Robotics and Computer-Integrated Manufacturing, 49 (1), 88-97.

[6] Matteo Russo, Marco Ceccarelli, and Burkhard Corves, 2017, Design and test of a gripper prototype for horticulture products, Robotics and Computer-Integrated Manufacturing, 44 (1), 266-275.

[7] M. Honarpardaz, M. Tarkian, J. Ölvander, and X. Feng, 2017,Finger design automation for industrial robot grippers: A review, Robotics and Autonomous Systems, 87 (1), 104-119.

[8] Nestor Eduardo Nava Rodríguez, Giuseppe Carbone, and Marco Ceccarelli, 2006, Optimal design of driving mechanism in a 1-DOF anthropomorphic finger, Mechanism and Machine Theory, 41 (8), 897-911.

[9] Shigeo Hirose, Yoji Umetani, 2010, The development of soft gripper for the versatile robot hand, Mechanism and Machine Theory, 13 (3), 351-359.

[10] Yang Chen, Shaofei Guo, Cunfeng Li, and Hui Yang, 2018, Size recognition and adaptive grasping using an integration of actuating and sensing soft pneumatic gripper, Robotics and Autonomous System, 104 (1),14-24.

[11] Ali Talib Jawad, Hassan Muwafaq Gheni, Nabeel Jabal Abed, and Noor S. Ali. 2023, Design of adaptive controller for robot arm manipulator based on ANN with optimized PID by PSO algorithm:

AIP Conference Proceedings 2591, 030047.
[12] G.J. Liu, and A.A. Goldenberg, 1992, Experiments on robust control of robot manipulators, Proceedings 1992 IEEE International Conference on Robotics and Automation, 1935-1940.
[13] V G Pratheep, M Chinnathambi, E B Priyanka, P Ponmurugan, and Pridhar Thiagarajan, 2020, Design and Analysis of six DOF Robotic Manipulator, IOP Conf. Series: Materials Science and Engineering, 1055 012005.

Role of AI in Control System Design for Robotics

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A B S T R A C T

In this study, the role of AI in controlling the robotic system has been discussed in a comprehensive manner. For executing this study, AI has been introduced with its features, implications and loopholes that directly affects the universal digital technology. Places and sectors that have adopted AI to bring growth have been discussed in this chapter. Nowadays different types of advanced technologies have been invented to track human body motion and other features that make people's life more easy and advanced. Here cognitive implementation of technical systems has been discussed briefly along with its loopholes that need improvement to overcome these barriers. Assistive kitchens with their equipped tools have been mentioned in this study with brief description and manufacturing and other business industries have also discussed here that adopt AI technology to bring growth.

Keywords:AI, Cognitive technical system, control system, industry, robotics, and sensor

INTRODUCTION

Realisation of analytic capability like learning, perception, planning, reasoning and execution for technological systems has been established by cluster of excellence (CoTESYS). It includes a flexible manufacturing system, humanoid robotics along with autonomous vehicles such as blimp. Ultimate goal of this cognitive system is to use the knowledge and experience of human beings to make a better future that can raise the capabilities of an individual [1]. Robotics and automation systems are adding up a level on the existing digital system that makes human life more comfortable and easier. Cognitive technical system is immensely flexible, adaptive, reliable and robust that makes quick cooperation and interactions with human beings.

Cognitive technical system (CTS) is an information processing technology that includes artificial actuators and sensors, embedded and integrated into the corporate system. In this study the role of AI in controlling robotics systems has been discussed comprehensively. Artificial robotics (AI) is an extremely powerful combination that has been designed to conduct automatic tasks of the factory setting [2]. Implication of AI in the robotic industry, implementation of cognitive technical systems has been discussed in this study with its loop in action. Hence it can be stated as AI is immensely smart decision making technology that solves complicated problems at a glance.

AI IMPLICATIONS IN ROBOTICS

Implication of AI in robotics is needed as it accomplishes tasks simply with right orientation and positions. CTS requires AI technology along with solid grounding systems that have insight from the CoTESYS, cognitive structures that perform empirical study and fundamental research in the context of testbeds of demonstration [3]. It has been predicted that the number of robots is going to increase in the future. However, autonomous systems and robots are expected to be widely exploited in society in the future that includes service robots and self-driving vehicles at home and at work platforms. Technologies and systems that have surrounded us are taking different shapes to bring improvement in human life. AI contributors have different perception and object related orientation in respect of the robotics industry. It has been observed that AI research inspires technological systems that are to be equipped with mechanisms that are related to cognitive.

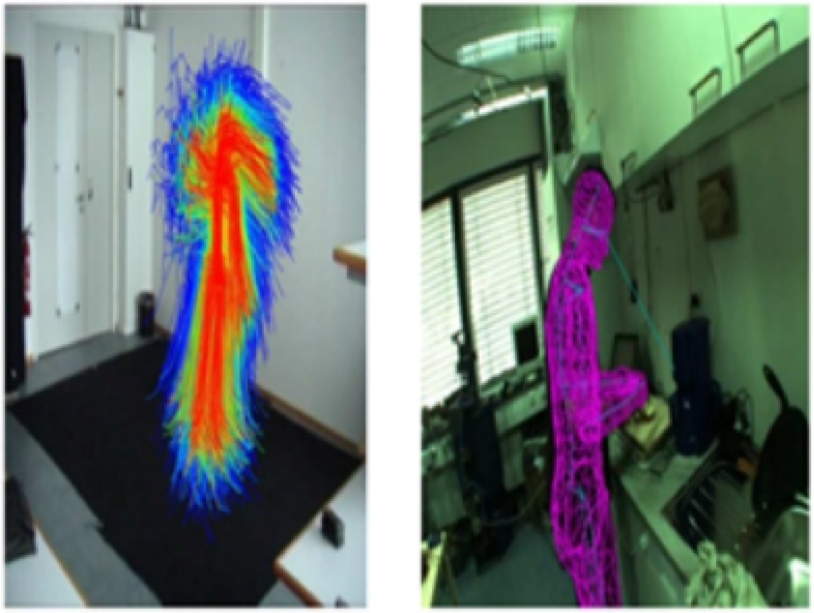

Figure 1: Body motion tracker based on 3D vision (Source: [3])

Trajectory data and accurate motion requires focus from AI technology that can track multiple digital images from human bodies. Tracking human body parts needs learning components in the appearance model. AI method measures the highly effective performance of the robotic industry that has context with embedded applications of robot and sensor equipped [4]. It is immensely important that AI researchers should study research from a close view in respect of research disciplines. For example it can be stated as research on motion planning and manipulation has surpassed AI planning technology. Driving AI research can be based on cognitive technical systems that prove relevance to realise high performance of autonomous systems of robotics.

AI and robotics includes autonomous transportation, cooperation and coordination mechanically, ethics and value to digital technology and intelligence augmentation that has been currently focused by World Economic forum (WEF) [5]. Hence it can be said that the robotics industry is getting advanced and improved day by day by using AI technology efficiently.

EVALUATION OF ACTION LOOP

It has been observed by CoTESYs that CTS have some close loops in perception and action based systems. The image represents that the architecture cognitive system has perception of multiple sensors, cognition like knowledge, and learning and action plan along with action. At top level, key components of environmental models, management related to learning and knowledge have connected tightly to physical action [6]. From the given image it has been obtained that perception of mapping technical systems onto cycle of perception action should recommend modules of functional decompose cognition. It consists of a module of motor action performed, another single reasoning and others [7].

From the right figure it reveals that different types of cognitive capabilities should be more interconnected and intense in order to succeed needed synergies [8]. CoTESYS investigated that common loops have been obtained in key components like action, knowledge, perception, learning and more.

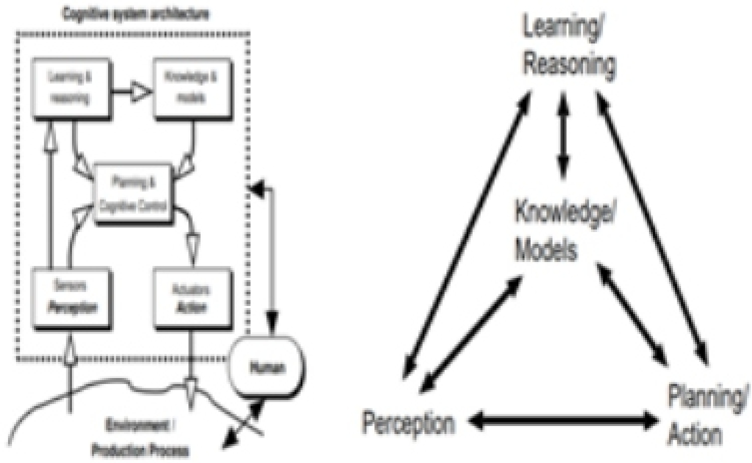

Figure 2: Architecture of cognitive system (Source: [8])

Perception is accession of data and information related to an actor's body and environment. AI is a sub part of computer science that is basically concerned with action and perception; perception is closely related with estimated probabilistic problems [9]. In addition to that, estimated states are gradually transformed into figurative representations that authorise the systems to reason and communicate about the way of perception. Complicated action sequences and plans at upper level and primate brains using a range of quasi-hierarchy from lower elementary motor has created close loops in the cognition perception.

COGNITIVE IMPLEMENTATION OF TECHNICAL SYSTEM

Assistive kitchen is an omnipresent sensing, actuation environment and computing with robotic assistant that targets enlarging cognitive capabilities along with monitoring people's safety and health. For achieving these goals assistive kitchens need to interpret, perceive and learn models in respect to household chores. In addition to that, assistive kitchens can use the acquired model to monitor safety and health assessment [10]. Image that is presented below shows varieties of sensors that have been provided by the environment of the sensor that includes RFID tags, laser range finders and more. AI is used to design the control system of a robot to operate the overall activities of the robotic industry. It also leads an immensely important role in growth of technological development of a country.

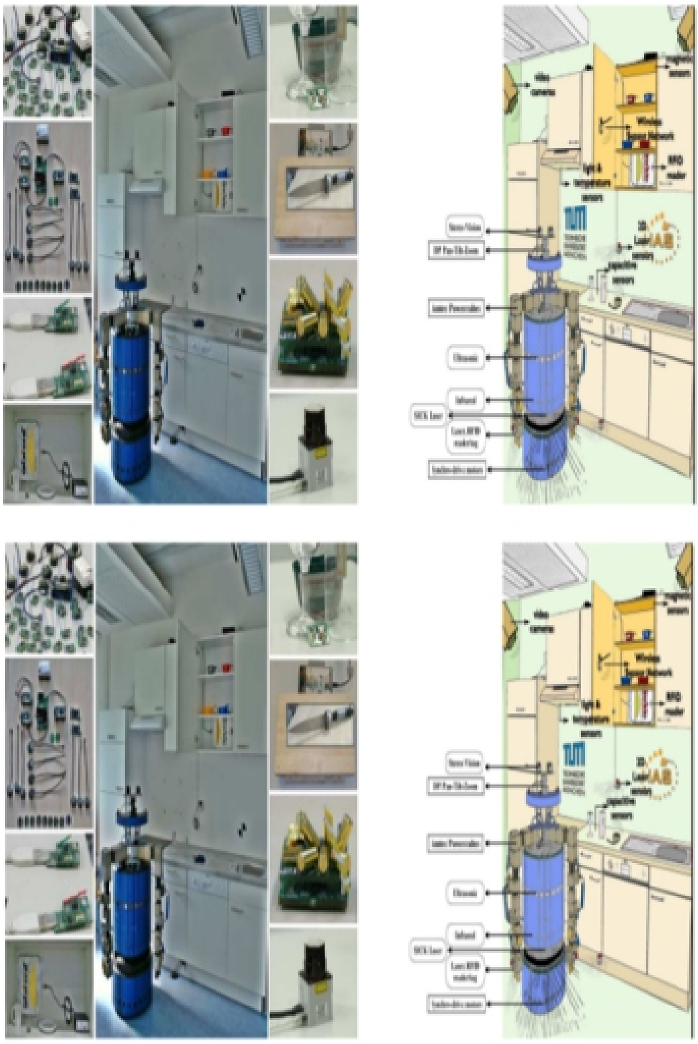

Figure 3: Assistive kitchen contains different types of sensors and robot
(Source: [10])

Hardware and software integration of the kitchen consists of network sensing and mobile robots that are embedded physically with the environment. It disposes of sensor furnish furniture, sensor in respect of global environment and appliances related to web enabled, " smart" objects and more [11]. The Discussing kitchen contains cameras on the shelf that cover the wide area of the kitchen with high resolution in the working segment. Furniture that contains varieties of sensors such as cupboards with undiminished RFID that gives authorization to know identities of tagged objects insight into the system [12]. In addition to that, kitchen tools and utensils are furnished with integrated sensors. For example a knife that is made based on a 6DOF torque sensor that enables it to record force direction over extended time. AI systems are used in the robotic industry to control the overall design that can give the desired level of outcome expected by scientists and researchers

In this context, it can be observed that, the atmosphere of Mars is highly dense and it may take more than 22 minutes to transfer signals between Earth and Mars. On the other hand, the scientific ingenuity required high performance computers for conducting the autonomous navigation system, in that case, Robotics and other technological equipment should be lightweight. However, scientists from NASA have not successfully gathered the knowledge of these cutting-edgetechnologies. Another issues that affect the exploration in Mars mission is the "On orbit construction" [9]. On the other hand, solar flare present in the outer space region is extremely high, and it may cause solar irradiance for any humans or machines. The volatile situation or Zero gravity in the outer Earth, can be considered as another challenging factor for AI robots [14]. The Mars mission required heavy load transportation handling capabilities to successfully conduct the mission. The weight of those heavy equipment should be carried out after proper calculation and measurements. A lack of measuring the distance between the primary load location and the ultimate destination can lead to disrupting the entire Mars mission. In that case, it can be observed that the total amount of power required for the habitation purpose on Mars is 30-60 KW. On the other hand, the survival of robots in those environments may differ a lot from human In that case, the scientists from NASA have started the investigation on the needs for robots in the outer Earth environment [10]. In that case, colonisation on Mars may be difficult for humans due to the necessity of "nuclear power generator equipment". Apart from that, Mars habitat, environment and resources are still not enough for the habitation process of human beings in the 20th century.

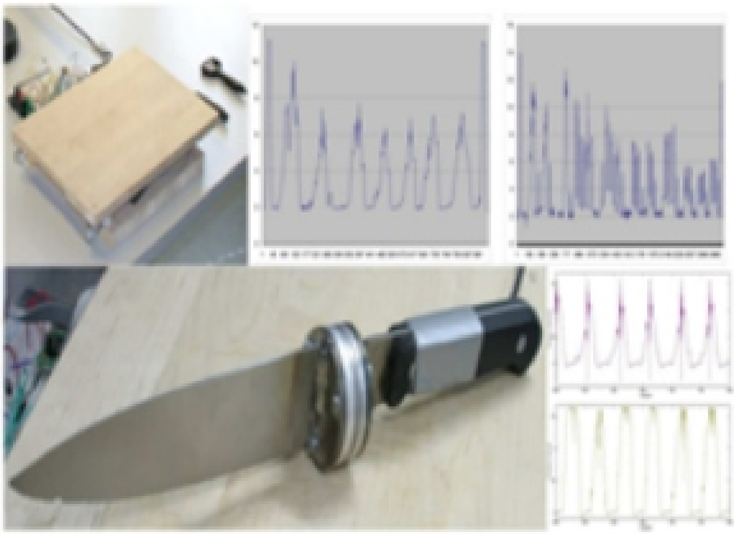

Figure 4: Knife with wireless network sensor
(Source: [12])

Cognitive network for sensor estimates the events of domains that include interpreting, combing, abstracting and interpreting the sensor data of various sensors over a long time. For example it can be stated as RFID acceleration sensors to utensils the environment to recognise states of four dynamics like pick up or put down objects [13]. Identification of dynamic force states is crucial for segment activity by meaningful sub actions. Networks have played a significant role in monitoring particular activities in a comprehensive way.

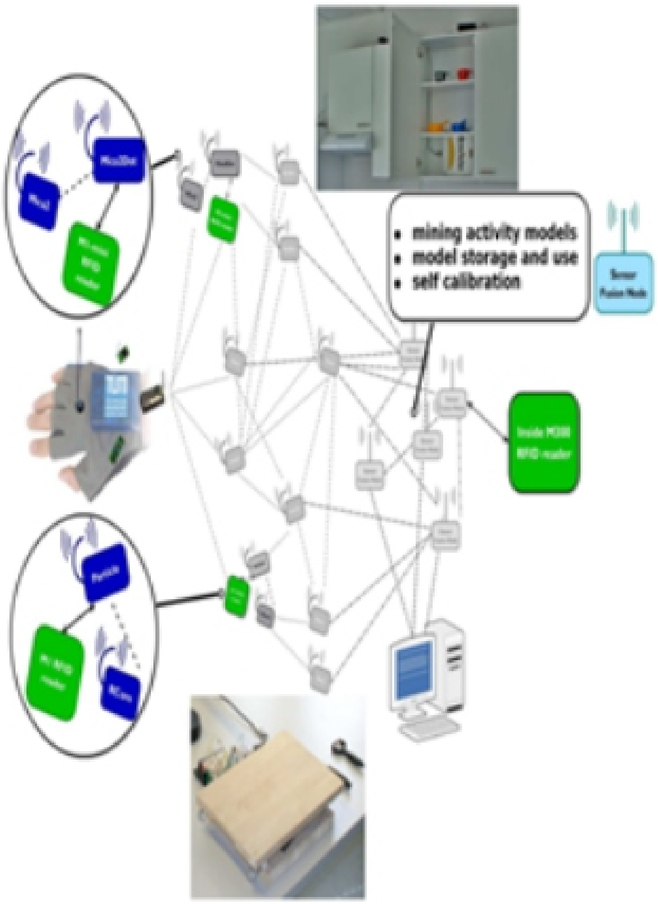

Figure 5: Assistive kitchen's sensor network
(Source: [13])

Sensor robotic assistant and kitchen equipment helps in accomplishing suitably large numbers of consciousness tasks. It has determined relevant objects in a cluttered sense, classifying and determining the positions that can manipulate grasp point [14]. This type of system has been controlled by using AI technology that monitors the overall integrity of robotic systems. Additional resources of meaningful semantic components of nature have been perceived by robots by using a common sensor network [15]. Different types of perceptual capabilities of humans are required detection, recognition and understanding of human body language. Perception of human activities has challenged the sensors of kitchens that can identify and interpret activities of human beings over a long time. Robotic assistant perception systems have determined the motion and precise parameters of human manipulation tasks like having breakfast, cleaning up, preparing tea or coffee and others. Moreover, after long time observation this type of domestic AI has been used in the robotic industry to make human lives more comfortable and easier.

The AI system not only changes the scenario of domestic lifestyle, in addition to that, it has also changed the scenario of business and different industries. Organisations and companies are implementing AI in their business activities to take quick decisions and to embrace the master transformation faster [16]. Artificial intelligence helps solve complex business problems and it is a time consuming and comprehensive capital intensive system that has been proven to succeed. Message from AI and 4IR technology has taken place in the discussion of 40 high level panels and secondly in global industrialization and manufacturing. Increase of automation technology in the robotic industry has developed the technological model and decisions of companies in reputedly manner [17]. It has been observed that social robots are primarily heavier in interaction of application in comparison to robots of industries that give possible benefits in ramification of borders. For evaluating the application of social robots in the technological industry it is important to analyse beneficial effects of robots in the production system of an organisation.

Nowadays most of the countries are using AI in different economic sectors such as manufacturing, agriculture, service sectors like transportation, finance, defines and public administration. Using AI is the reason for rapid growth of GDP of a country that helps to bring growth in economic and social life of a country [18]. Technological improvement has been influenced by using AI systems being a reason for innovation in different contexts of countries. AI leads the economic development of a country that has been recommended and adopted by governments of several countries. Internet robotics has connected different platforms by a chain such as it makes a bridge between electrical engineering, computer science, biology, physics, cognitive science, artificial intelligence and so on [19]. AI connects hardware's, sensors and actuators in electrical engineering, logics, errors estimation and algorithms have been connected with mathematics comprehensively.

Robotic in factories has been given an important role such as enhancing experiences of customers, minimising errors by using robotic technology, increasing productivity by using 24/7 services and so on. In addition to that, AI in robotics industries has also been applied in the medical science that changes the scenario of medical sciences [20]. Artificial intelligence includes building relationships with mathematics, biology, philosophy and more. In addition to that it has adopted different types of methods, scientific perspective and technological perspective. Hence it can be stated as AI in robotics has been implemented in different industries such as medical, science, industry, manufacturing, domestic appliances and others have also adopted this advanced technology to enhance the productivity level.

CONCLUSION

Cluster of excellence investigates realisation analytical capabilities that include learning, reasoning and planning for executing technological systems. Cognitive technical systems include artificial actuators and sensors that are integrated with corporate systems. AI has uses in different segments such as manufacturing, domestic, medical science, electrical engineering and so on. It plays a crucial role in increasing the rate of GDP of a country along with it helps to change the scenario of economic and social life of a domain. Different Types of robots have been invented to measure the motion of a human body by using 3D vision. However there are also some loopholes that create some obstacles in spreading the use of AI all over the world. Cognitive technology has been used in different segments such as assistive kitchen, advanced equipment and utensils, sensor network and so on that have been discussed above. Hence it can be concluded as AI leads an immensely important role that makes human life easier and comfortable.

REFERENCES

[1] Schirrmeister, R.T., Springenberg, J.T., Fiederer, L.D.J., Glasstetter, M., Eggensperger, K., Tangermann, M., Hutter, F., Burgard, W. and Ball, T., 2017. Deep learning with convolutional neural networks for EEG decoding and visualization. Human brain mapping, 38(11), pp.5391-5420.

[2] Tussyadiah, I., 2020. A review of research into automation in tourism: Launching the Annals of Tourism Research Curated Collection on Artificial Intelligence and Robotics in Tourism. Annals of Tourism Research, 81, p.102883.

[3] IROMINI, N., BTc, A.S.I., COd, O.K.U.W.A. and GBADAMOSI, K., 2021. FACIAL EXPRESSION RECOGNITION SYSTEM USING KNN. Technology (ICONSEET), 6(4), pp.31-38.

[4] Gunning, D. and Aha, D., 2019. DARPA's explainable artificial intelligence (XAI) program. AI Magazine, 40(2), pp.44-58.
[5] Makridakis, S., 2018. High tech advances in artificial intelligence (AI) and intelligence augmentation (IA) and Cyprus. Cyprus Review, 30(2), pp.159-167.
[6] Panetto, H., Iung, B., Ivanov, D., Weichhart, G. and Wang, X., 2019. Challenges for the cyber-physical manufacturing enterprises of the future. Annual Reviews in Control, 47, pp.200-213.
[7] Ritter, F.E., Tehranchi, F. and Oury, J.D., 2019. ACT-R: A cognitive architecture for modeling cognition. Wiley Interdisciplinary Reviews: Cognitive Science, 10(3), p.e1488.
[8] Hewett, C.J., Wilkinson, M.E., Jonczyk, J. and Quinn, P.F., 2020. Catchment systems engineering: An holistic approach to catchment management. Wiley Interdisciplinary Reviews: Water, 7(3), p.e1417.
[9] Berendt, B., 2019. AI for the Common Good?! Pitfalls, challenges, and ethics pen-testing. Paladyn, Journal of Behavioral Robotics, 10(1), pp.44-65.
[10] Galimova, E.G., Konysheva, A.V., Kalugina, O.A. and Sizova, Z.M., 2019. Digital educational footprint as a way to evaluate the results of students' learning and cognitive activity in the process of teaching mathematics. Eurasia Journal of Mathematics, Science and Technology Education, 15(8), p.em1732.
[11] Sahu, S. and Silakari, S., 2021. Analysis of Energy, Coverage, and Fault Issues and their Impacts on Applications of Wireless Sensor Networks: A Concise Survey. network, 10, p.13.
[12] Su, J., Sheng, Z., Leung, V.C. and Chen, Y., 2019. Energy efficient tag identification algorithms for RFID: survey, motivation and new design. IEEE Wireless Communications, 26(3), pp.118-124.
[13] Su, J., Sheng, Z., Liu, A.X., Han, Y. and Chen, Y., 2019. A group-based binary splitting algorithm for UHF RFID anti-collision systems. IEEE Transactions on Communications, 68(2), pp.998-1012.
[14] Cesta, A., Cortellessa, G., Orlandini, A. and Umbrico, A., 2018. A Knowledge-based Planning and Acting System for Assistive Robots. In AIRO@ AI* IA (pp. 42-50).
[15] Modoni, G.E., Trombetta, A., Veniero, M., Sacco, M. and Mourtzis, D., 2019. An event-driven integrative framework enabling information notification among manufacturing resources. International Journal of Computer Integrated Manufacturing, 32(3), pp.241-252.
[16] Li, Z., He, Q., Xu, X., Zhao, Y., Liu, X., Zhou, C., Ai, D., Xia, L. and Mai, L., 2018. A 3D Nitrogen-Doped Graphene/TiN Nanowires Composite as a Strong Polysulfide Anchor for Lithium–Sulfur Batteries with Enhanced Rate Performance and High Areal Capacity. Advanced Materials, 30(45), p.1804089.
[17] Li, H., Gadinski, M.R., Huang, Y., Ren, L., Zhou, Y., Ai, D., Han, Z., Yao, B. and Wang, Q., 2020. Crosslinked fluoropolymers exhibiting superior high-temperature energy density and charge–discharge efficiency. Energy & Environmental Science, 13(4), pp.1279-1286.
[18] Ulnicane, I., Knight, W., Leach, T., Stahl, B.C. and Wanjiku, W.G., 2021. Framing governance for a contested emerging technology: insights from AI policy. Policy and Society, 40(2), pp.158-177.
[19] Panetto, H., Iung, B., Ivanov, D., Weichhart, G. and Wang, X., 2019. Challenges for the cyber-physical manufacturing enterprises of the future. Annual Reviews in Control, 47, pp.200-213.
[20] Betz, U.A., Betz, F., Kim, R., Monks, B. and Phillips, F., 2019. Surveying the future of science, technology and business–A 35 year perspective. Technological Forecasting and Social Change, 144, pp.137-147.

Construction of Artificial Minds with a Probability Learning Model

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ABSTRACT

The concept of AI has gained a lot of attention because of its contribution towards analysing data and thereby making optimal decisions during problem-solving. Many researchers after researching various AI theories have developed numerous AI technologies that are capable of making decisions in complex situations. However, human minds act optimally and sometimes make decisions that are rational and this leads researchers to develop a more advanced AI technology that can make rational decisions and fully imitate the human mind. Thus, in this article, a probability learning model has been proposed that is capable of making rational decisions. The findings of the research show that the selected model of Artificial Mind has the ability to make human-like decisions. The paper further examines the ways through which several problem-solving tools can be improved.

Keywords:AI, artificial mind, machine learning, probability learning model.

INTRODUCTION

There exist various problem-solving techniques among this Artificial Intelligence (AI) and Machine Learning (ML) are becoming two of the most popular techniques in various areas of research and industry. As Intelligence is a mental ability to solve numerous problems many researchers are giving a lot of attention to AI in several fields. Through utilising multiple factors of computers individuals can use it for making the right decisions. Individuals can also improve their intelligence with the help of learning. The knowledge individuals learn through experience or through study can further enhance the person's learning. In other words, MI refers to the concept in which the computer learns by accessing data.

In recent times with the help of advanced technologies, we have improved and enhanced AI using ML and this is important as AI has the ability to make computers more technologically advanced and intelligent. Researchers are now prioritising optimal decisions and focusing on developing the technology so advanced that the computer can operate and take decisions like the human mind.

Artificial Mind (AM) was introduced by Stan Franklin and in this technology, he linked the mind of animals with the mind of AI. The importance of AM is huge as its contribution to the AI system for the healthcare department is effective in terms of providing support services for elders.

The reason behind developing this technology is that most individuals and especially elders expect computers to operate and think like themselves. In this research article, a methodology has been created with the assistance of probability learning based on statistical learning theory or with a statistical approach. The aim of this study is to examine the way this probability learning model can be utilised for problem-solving.

Artificial Mind and Machine Learning

AI and ML are quite similar although AI is developed to make intelligent computer programs and on the other hand, ML is focused on the way with which these computer programs can automatically improve themselves by accessing data. According to [1], AI technology can be used for multiple purposes which include “abstract reasoning”, planning the ways an organisation or employee can achieve a particular goal. Other tasks which can be achieved successfully with the help of AI are "generalising about the world", identifying objects and sounds, translating, speaking, performing business transactions, and even regulating robotics technologies. The difference between AI and "Machine Learning" is that when a program has the ability or can think like a human being can be AI but when this program has the ability to automatically learn by accessing various required data then it is ML.

The method of learning is an estimation process between input and output in a system. It can be stated here that ML is a learning method of a computer by accessing observed data that enables the computer to make optimal decisions. Conversely, another task of ML is to go through the learning process from experience or observed data that can direct computers to perform the right behaviour. [2] Furthermore, another way computers can learn from the observed data is through the use of a tool called “Statistics”. Both ML and Statistics are developed to enable the computer to carry out optimal decisions to solve a partial problem. This utilizes one fixed value which is estimated using an analytical model to carry out optimal decisions and is a representative “Artificial Intelligence” approach [3]. It should be mentioned here that the way AI operates is quite different in respect to the way a human mind works as the human mind does not take decisions at a given problem by being dependent on a single value. Generally, human beings make multiple decisions for problem-solving. Although these differences exist this does not deviate noticeably from the optimal value.

Another problem-solving technique that is gaining popularity is Deep learning (DL). DL is also quite similar to ML which is focused on algorithms based on the structure and function of the brain, known as, “artificial neural networks”. All these techniques complement each other and their combination only can contribute towards building a more advanced technology [4].

The implication of probability learning model in developing artificial mind

Usually, the performance of AI for carrying out optimal decisions is based on ML which includes statistics under observed data. This process results in providing only one estimated value for searching optimal decisions. Probability is a key factor in ML and an individual cannot develop a deep understanding and implications of ML without the assistance of probability [5]. In other words, the importance of probability lies in handling uncertainty. Usually, uncertainty occurs when a decision is made with insufficient information and involves risk. The impact of probability in ML is huge as the probability is based on mathematics and a statistical approach that provides the effective tools and language that compute and calculate the uncertainty of events and reasons in a righteous manner. There exist various reasons that lead to the need for probability in developing AM, these include the existence of "unpredictable outcomes", the occurrence of an unknown error, or the occurrence of difficulties in handling large possibilities of predicates [6]. In simple words, the probability is the measure of how likely an event can occur.

It should be mentioned here that the value of 0 and 1 which is the representative of ideal uncertainties. This paper examines the behaviour of the human mind as an Artificial Mind approach. The below figure shows a comparison between AI and AM approaches.

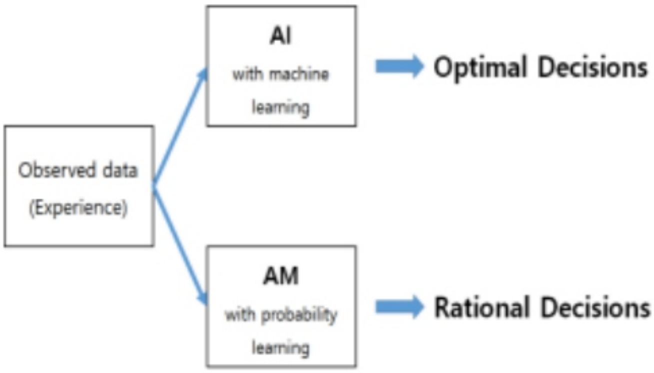

Figure.1: Comparison between "Artificial Intelligence" and "Artificial Mind"
(Source: [7])

As previously mentioned AI is dependent on the ML algorithm for making optimal decisions under the observer data. In this study, the probability learning model, AM which is selected is dependent on probability learning and makes rational decisions. In this article, the rational decision provides nimbus values for problem-solving. Here, in this study, a regression problem is considered for making a comparison between "Artificial Intelligence" and "Artificial Mind". The aim of AI is to imitate, automate and augment rational intelligence. Moreover, the human being's mind is not just of rational intelligence but other cognitive and irrational intelligence. It could be explained mathematically as well, human mind = "rational intelligence" + "cognitive intelligence". On the other hand, the artificial mind can also be explained mathematically, AM = "artificial irrational intelligence" + "artificial cognitive intelligence" + "Artificial Intelligence".

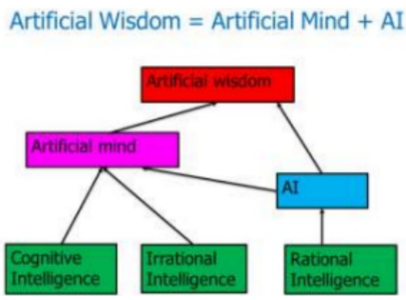

Figure 2: Artificial Wisdom
(Source: [8])

The above figure shows that artificial wisdom is also similar to AI which is developed to make top-level decisions when encountered with a complex or adverse situation. Hence, it can be stated that with the help of advanced AI technologies various problem-solving tools are becoming more efficient.

METHODS AND TECHNIQUES

In this paper, the probability learning model which is chosen is Artificial Mind to find the ways in which AM operates to make rational decisions at given problems. This model is created to verify the performance this reach is developed to propose and estimate the findings of the research. Hence, an experiment has been made to discuss the result of this research material [9]. In this study to explain the ways through which this finding of this article can be applied to real problems, an experiment has been conducted using a "Machine Learning" learning dataset which is collected from the UCI machine learning repository. In this study, the IRIS data set has been chosen which consists of 1 categorical variable and 4 continuous variables. These four continuous variables include Sepal Width (SW), Petal. Width (PW), Sepal Length (SL) and Petal Length(PL).

RESULT AND DISCUSSION

From the above-mentioned probability model, it is found that a certain categorical variable and four continuous variables are used to develop a system with an artificial mind. A model of multiple regressions is also considered in this research paper to attain insightful detail regarding the optimum Artificial mind (AM) with probability learning. As per the outcome of this multiple regression framework, a set of probability distributions is also identified. This probability distribution is represented in the following figure along with the parameters of regression:

$$\tilde{b}_0 \sim N(1.8560, 0.2508^2)$$
$$\tilde{b}_1 \sim N(0.6508, 0.0667^2)$$
$$\tilde{b}_2 \sim N(0.7091, 0.0567^2)$$
$$\tilde{b}_3 \sim N(-0.5565, 0.1276^2)$$

Figure 3: Probability distribution parameters
(Source: [10])

Above mentioned regression parameters are found to be used to design the Sepal length (SL) of the system equipped with an artificial mind. In addition to that, certain values are also predicted by the researchers to find out other dimensional parameters such as Sepal width, Petal Length, and Petal width. However, it is also found from existing studies that practical results can deviate from the experimental values that are taken as predictions [11]. This deviation in the values is represented as ε and this value is found with the help of normal distribution. As per the existing research studies it is also found that this value of error is associated with a mean of 0 whereas the value of variance is calculated with the help of σ2. Apart from that, a set of the following equation is also identified to find out the value of SL:

$$SL = 1.8560 + 0.6508SW + 0.7091PL - 0.5565PW$$

Figure 4: Formula for calculating SL
(Source: [12])

On putting the value of SW as 3.1, PL as 3.8, and PW as 1.2 the value of SL can be estimated as 5.923622. This predicted value is helpful to make a suitable decision regarding the development of an artificial mind. After achieving an idea regarding the development of AM, an adequate set of multiple regression analysis is also found by different researchers. This kind of analysis is suitable to find out the effectiveness of AM in resolving complex practical problems optimally. Based on the outcome of regression analysis, the researcher has predicted that the AM system gives different responses at different intervals of time. However, a value nearest to the optimal one is also identified by the researcher. As a result of this kind of experiment, a beneficial result can be provided in the field of developing systems with artificial intelligence equipped with AM [13]. In the contemporary period, AM-based systems are useful in different practical applications such as robotic systems in healthcare and others. In this paper, a comprehensive idea is evolved in context to the development of AM that is functional in practical activities [14]. Therefore, it can be stated that this paper is also beneficial for future works regarding the implication of AM based on probability models.

CONCLUSION

In conclusion, taking note of the current condition of making human-like decisions, it can be stated that the importance of AI, "Machine Learning ", Deep Learning" is immensely growing. In this paper, the concept of AI and "Artificial Mind" has been compared and distinguished according to their contribution in making rational and optimal decisions in a given situation. The finding of the research reveals that the core difference between AI and AM is that AI is based on one single value while AM has the capability to make multiple decisions and AM does this in this study by collecting multiple values from the selected approach. In order to explain the ways, this study is relevant and the finding of research can be applied in solving a real problem in an experiment of linear regression analysis has been developed. This research article is relevant in terms of finding the root and continuous progression of AI which is developing with the help of advanced technology.

REFERENCE

[1] Rabinowitz, N., Perbet, F., Song, F., Zhang, C., Eslami, S.A. and Botvinick, M., 2018, July. Machine theory of mind. In International conference on machine learning (pp. 4218-4227). PMLR.

[2] Perruchet, P., 2019. What mechanisms underlie implicit statistical learning? Transitional probabilities versus chunks in language learning. Topics in cognitive science, 11(3), pp.520-535.

[3] Flesch, T., Balaguer, J., Dekker, R., Nili, H. and Summerfield, C., 2018. Comparing continual task learning in minds and machines. Proceedings of the National Academy of Sciences, 115(44), pp.E10313-E10322.

[4] Mahadevan, S., 2018, April. Imagination machines: A new challenge for artificial intelligence. In Proceedings of the AAAI Conference on Artificial Intelligence (Vol. 32, No. 1).

[5] Vinanzi, S., Patacchiola, M.,Chella, A. and Cangelosi, A., 2019. Would a robot trust you? Developmental robotics model of trust and theory of mind. Philosophical Transactions of the Royal Society B, 374(1771), p.20180032.

[6] Spicer, J. and Sanborn, A.N., 2019. What does the mind learn? A comparison of human and machine learning representations. Current opinion in neurobiology, 55, pp.97-102.

[7] Páez, A., 2019. The pragmatic turn in explainable artificial intelligence (XAI). Minds and Machines, 29(3), pp.441-459.

[8] Bjerring, J.C. and Busch, J., 2021. Artificial intelligence and patient-centered decision-making. Philosophy & Technology, 34(2), pp.349-371.

[9] Marcot, B.G. and Penman, T.D., 2019. Advances in Bayesian network modelling: Integration of modelling technologies. Environmental modelling& software, 111,pp.386-393.

[10] Jun, S., 2017. A Probability Learning Model for Constructing Artificial Minds. International Journal of Applied Engineering Research, 12(12), pp.3542-3545.

[11] Calvano, E., Calzolari, G., Denicolo, V. and Pastorello, S., 2020. Artificial intelligence, algorithmic pricing, and collusion. American Economic Review, 110(10), pp.3267-97.

[12] Moreno-Guerrero, A.J., López-Belmonte, J., Marín-Marín, J.A. and Soler-Costa, R., 2020. Scientific development of educational artificial intelligence in Web of Science. Future Internet, 12(8), p.124.

[13] Paltrinieri, N., Patriarca, R., Stefana, E., Brocal, F. and Reniers, G., 2020. Meta-learning for

safety management. Chemical Engineering Transactions, 82, pp.169-174.
[14] Scherer, M., 2019. Artificial Intelligence and Legal Decision-Making: The Wide Open?. Journal of international arbitration, 36(5).

Network Optimization Using Learning and Distributed Intelligence through Cognition-Based Networks

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A B S T R A C T

Network optimisation can be achieved with the incorporation of sophisticated technology and advanced algorithms to achieve efficiency and scalability. Optimisation of the entire network with learning and distributed intelligence through cognitive-based networks is investigated in the paper. A cognition-based network enhances the capacity for network optimization and designing processes to offer better services to the customers appropriately. With the rapid growth of users, the network distribution channels are required to adopt cognitive-based architecture for optimised capacity, capable of providing secure data transmission to a wider user base. 5G network construction with SDN and NFV, along with AI and machine learning algorithms are considered to be the most efficient cognitive-based approach for network optimisation. The application of NFV helps to develop network functions in operating open hardware platforms, reducing Capex, and OpenX and improving network design efficiently. On the other hand, SDN is capable of separating the control plane and the data plan with a defined interface for programming, providing an entire view of the network with centralised control.

Keywords:AI, machine learning, cognition-based networks, network optimisation, NFV, SDN.

INTRODUCTION

Network optimization helps to apply industrial leading technology in the network life cycle for developing network performance with the strategic objective and develops the return on the investment. This factor helps communication service providers to gain an edge with the help of data-given optimization technology in developing scale and complexity in the network process. The cognition network is defined as a type of data network that helps to utilize cutting-edge technology from different research areas such as machine learning prediction computer networking network management [1]. This factor helps in resolving problems in the current network related to the design and operation of communication networks. Cognition network access to apply cognition process for deciding an act on the addressed current issues with the help of network learning from the consequences of actions in the communication network. This factor creates a look at the network environment and provides an action plan according to the input obtained from the sensor and the network policies.

In India, 47% of internet penetration indicates the need of developing a cognition-based network in maintaining communication networks effectively. This factor helps to develop the learning and distribution process of intelligence with the usage of the internet through providing better service to the users [2]. The cognition process helps the devices the ability to transmit huge amounts of data with a reduction of energy consumption and efficiently use the available bandwidth. This factor helps the operational parameters to respond to the user's need for addressing the environmental condition that exploits the knowledge obtained in the execution of decisions for the further process. The system architecture of the “International Organisation of Standardization” (ISO) or “Open System Interconnection” (OSI) is an essential part of network design for its modularity in building optimization of individual groups of functionalities and developed scalability. This structure helps to increase the amount and variety of services developed over the network and efficiency of the internet service provider to continue enhancing the quality of service provided to the customers.

This factor shows that the current network architecture suffers from challenges due to the inefficiency of the underlying infrastructure and does not offer the capability of scaling up with the growing complexity of the communication networks. This growing complexity highlights the challenges in maintaining security and privacy to understand the connection with the network properly. The cognition learning process helps to provide the capability of continuous learning by optimising its performance and controlling the loopholes of the different services and resources in the network system [3]. This factor helps to monitor the environment under control and analyse the collected data effectively for developing the decision-making process in managing the cellular network effectively. The analysis of the collected data helps to perform the decided actions on the environment to get better results in network optimization and designing processes to offer better services to the customers appropriately. The objective of the study is to identify the influence of network optimisation in learning and distributing intelligence with the help of cognition base networks.

LITERATURE REVIEW

Significance of network optimisation in the cognition base network Network optimization helps to identify and predict the network data with the help of technology for pushing the network to provide maximum potential in resolving the performance issue. This activity of monitoring and predicting potential issues helps to technology plan for evaluating the future network demand and identify the expansion capacity for developing the returns effectively. This factor helps to understand the capture value of the 5G area and develop communication service-providing processes for adapting to the constant change of demands and expectations in emerging 5G cases. Network benchmark criteria help to expand the dynamics of communication services by identifying the key merits to focus on and the way of evaluating them effectively [4]. This factor helps AI Power Technology to identify the gaps through the downfall of the key merits in the root cause and resolve the issues with the help of an end-to-end network. Network optimization helps to develop traffic forecasting and performance prediction for determining critical congestion areas that cannot be resolved through the optimization process. This factor helps to develop the User experience by 15% and improve the external benchmark by 90% in the operating process of communication services with the help of internet services.[5] The cognition network techniques help to offer better protection from security attacks and network intruders and provide better services to the service operators and customers. This factor helps to focus on the development of network optimization in learning and distributing knowledge about the obligation in communication network services. The cognition-based network helps to analyse the network state and usage patent for recursion of network design and planning in enhancing the approach of communication services. This development helps to mice the network equipment for the reduction of network rollout of carbon emission and speeding the site acceptance for developing the subscriber's experience in a better way.

The cognition network helps to motivate by the observance of the lack of spectrum under the current network management policies that allow for combining new perception with the previous perception. This factor helps to understand the circumstances and determine the best line of action in resolving the current situation through maintaining policy and regulation of network management. This learning process helps to identify the patterns in the source usage and develop action in optimising the quantity network for achieving a high level of automation in operating network management and configuration tasks efficiently [6]. This factor has to instruct the way and the process of managing the system to control

the interfaces in achieving the organizational goal in a short period. The automation process helps to manage it and manage specific parts of the network through the development of knowledge and thinking about the operator and the environment process.
This intended automation helps to control system operations by stating the operation goal through detailed configuration performed by the management system in controlling the network distribution and designing [7]. Distributed intelligence helps to apply smart algorithms of the network operations and procedures to distribute and centralize AI in developing the performance in the continuous learning process.

Challenges of the cognition-based network in learning and distributed intelligence

The cognition-based network assists to develop the trend of the 5th-generation mobile systems in maintaining the communication services for the users. This system creates challenges in the device capability and traffic that develops functions in managing scalability and identifying the parameters in a single node number utilized in the system infrastructure. The network optimisation process helps to identify the efficiency of the resources such as bandwidth and energy in effective management of the quality of experience of the users through cognition networks [8]. The current cellular network is designed to serve a small number of users at a high bit rate with the help of downlinks that can create challenges in the massive access.

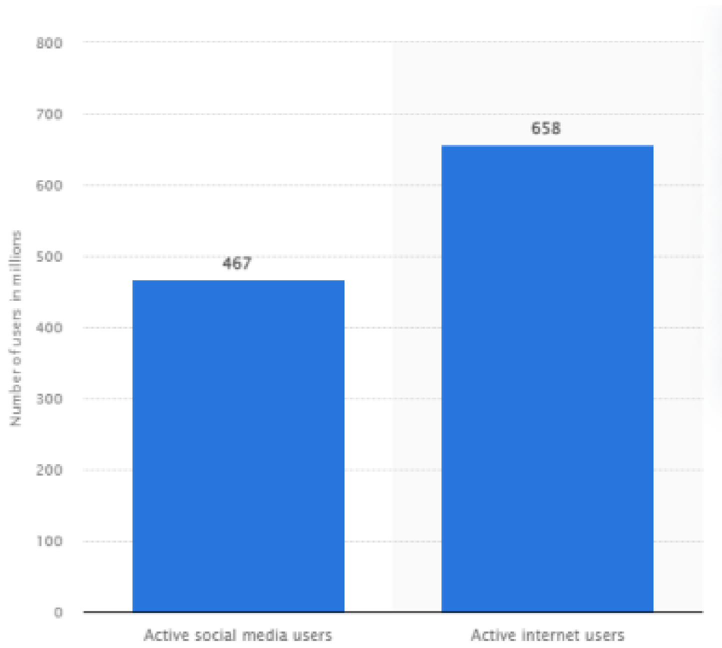

Figure 1: Number of Internet and social media users in India [9]

The above figure shows 658 million internet users in India and resulting in massive access to devices that prevalent uplink scenarios in the transmission process of short packets. The utilization of social media and cloud services at the same time can cause the generation of signalling overhead and lead to service outages in the current technology and protocols. The development of services increases the high-speed connectivity that increases in the near future and with the issue of placing the Festo base stations in the microcell.
These stations are known as "Heterogeneous Networks" (HetNets) and provide better coverage and

higher connection speed to mobile users and network operators.[10] Different density of the best station and backhaul connectivity causes new technical challenges that affect the design of efficiency handover policies, resource utilization, and service migration strategy. This factor causes challenges in introducing 5G services to the consumers and maintaining the user's experience with the cellular network process.

The high demand for wireless access points leads to the requirement of spontaneous multiple video connection at a dynamic rate through scalability coding and different quality requirements in maintaining communication services. This factor creates a problem generating a communication system for differentiating services and also includes per-flow in each class in providing content-based service optimization. The increment of topological and functional complexity in the networks leads to an automated mechanism in the cellular network for managing fundamental network operations that reflects self-configuration in the system parameter [11]. This factor helps to identify the self-optimization of the network performance through its coverage capacity, energy, and consumption for recovering the network personality and service fault in maintaining the cognition network effectively.

Self-X mechanism periods celebrity and full automation and also open challenges in managing network systems effectively that did not affect the design implementation of practical network-wide learning framework for network optimization. This factor creates a problem to maintain the learning approach of the network optimization due to the lack of infrastructure in the network management process. On the other hand, machine learning tasks lead to the performance of deep networks in the suitability of learning and adaptation of network optimization [12]. This factor builds difficult to provide effective service to the customers in maintaining the network services and traffic in providing internet services. The SDN tool did not utilize the network optimization process that creates a large-scale testbed in corporate with deep learning concepts in the network management process. This factor causes problems in maintaining the Indian cellular network among consumers and introduces fifth-generation services to Indian consumers. This challenge helps to identify the traffic and service infrastructure impact on the service-providing process and network management in India and developed the network engineering process efficiently.

Strategies to enhance the learning and distributed intelligence of network optimization

Recent trends show that the cross-boundary of layering architecture helps to develop more efficiency than the orthodox layered model in the network optimization process. This costly approach helps to provide good results in the resource challenge environment that helps the individual to collect knowledge about the correct time and the way to use cross-layered techniques. On the other hand, newly emerged network designs and capabilities involve software-defined network (SDN) and network function virtualization (NFV) for exploring the opportunities in the system and application [13]. The utilization of SDN helps to offer real-time visibility in the network performance and engineering the ability to reroute networks through developing reliability on the automation.

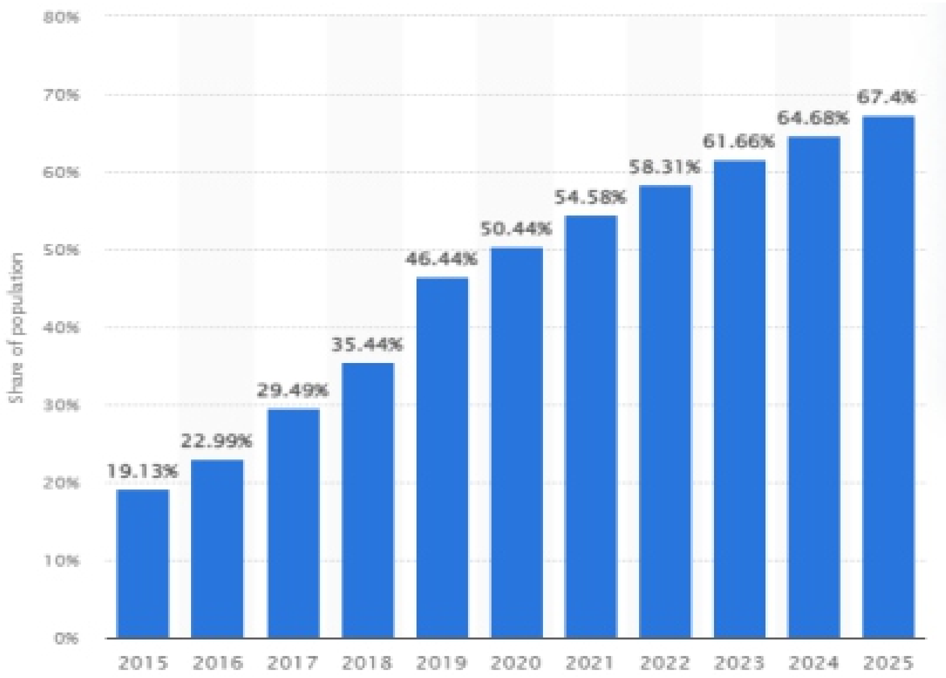

Figure 2: Usage of social networks in India population [14]

The above figure shows that the usage of social networks increased day by day that needs network optimization in managing cellular networks. The application of NFV helps to develop network functions in operating open hardware platforms, reducing Capex, OpenX and improving network design efficiently. This factor helps to apply network applications for reducing the maintenance and hard work costs in providing cellular networks. As per the CRISIL report, India has a 4G subscriber base of over 800 million by March 2022 that opens new opportunities for cellular networks [15]. 76% of respondents increased their spending time online on the backdrop of remote working, remote running, and entertaining themselves that reflects the effectiveness of network optimization. This factor provides a clear indication that India has successfully adopted 4G services in rural and urban areas and also has a welcoming approach towards the 5G services.

The usage of "user to edge" helps to deliver services in the current legal full structure for scaling up high CAPEX and time investment in developing the planning process of computer capacity and stored data leverage automation effectively. The network Optimisation process utilise open APIs for vendor agnostic for levelling up automation software in enhancing the simplicity of the network. The system integration helps the Telecom operators for developing their strategies in adopting network architecture for long-drawn processes and provides a fast-forward relook at the current availability in the regulatory allocation process [16]. This factor helps the network service providers to construct network plans in network strategy for the end users and develop the customer experience effectively. The emerging application requires more bandwidth with lower latency for meeting the requirements of quality experience and maintaining the expectation of the consumers that helps to develop the network architecture properly. The network helps to work as the virtualization capability for creating a close loop into automation in advance in the analytics and intelligence in self-configuration multi-layer infrastructure of the network management.

The cognition network assists applied AI in understanding the conservation surgery of the telecom operator for delivery of an uninterrupted experience to the end user and developing the legacy system.

This factor helps to provide proper delivery methods through the development of division processes according to the previous datasets related to network management for fulfilling customer needs. In the Indian telecom services, operators are developing the brand with hunger in requirements with the help of serving closer to the edge services, expanding edge cloud strategy, and automated open lean network [17]. Conveyance optical and IP Network provides real-time multi-lead views of the network that play an important role in optimizing the utilization of network and cloud resources. This factor helps to centralize the data centres of the hardboard explanation for balancing the system and monitoring the collected edges data in developing cloud strategy effectively.

METHODOLOGY

Study design

The cross-sectional study design helps the researchers to compare different variables related to network optimization in discovering the user's behaviour-related data in the communication services. This factor assists to learn more cognition-based networks in the learning and disturbing knowledge-related user experience any difficulty related to community service effectively. This study design helps to track the progress offered in a cross-sectional study in determining the network market in India that is efficient in network optimization with the help of cognition network services. The utilization of available resources helps to resolve technical challenges in mobile users and network operators in improving the designing process in enhancing the handover policies [18]. This factor guides to offer of content-based service optimization for enhancing the communication system approach in different services for maintaining scalability.

The network optimization helps to fulfil the growth for 5G services maintaining increased video consumption and reliable internet connectivity for fulfilling the requirements of study and work. This factor helps to apply cognition systems for interacting with the closed loop and understanding the system's needs and the way it happens helps to automatically resolve any resulting conflict. This system helps to understand the learning system and user behaviour in moving from reactive to proactive management for mitigating the future problem of network systems in advance.

Data collection

Effective data collection helps researchers to direct scarce resources related to the research topic in determining the service area for developing the data-driven decision in improving the research work. The secondary data is collected from online journals and articles related to network optimization and its influence on learning and distributed intelligence. The random sampling process guides to remove the bias from the gathered data for developing the quality of the research work for measuring the network optimization with the help of cognition networks. The conceptual design and practical implementation in maintaining a cognition-based network for advancing machine learning for understanding deep unsupervised learning networks in resolving difficult classification issues. This factor guides identifying the commercial diffusion in the parallel computing architecture in determining large-scale deep learning models in the cellular network [19]. The application of SDN and NFV assists to overcome the underlying issues of the internet and improves the flexibility management of the network. This factor helps to operate high-level operation goals in the continent network by outlining the Indian base automation for well-defined formal language in managing the network system. Cognition network involves explainable AI and trustworthy AI for developing the intelligence system in providing principles and values in managing cellular networks appropriately. This factor helps to knowledge representation and machinery in intent-based networking processes for enhancing the approach in network optimisation and designing processes that provide details about network issues.

Data analysis

The data analysis assists to present accurate and reliable data with the help of the secondary collected data for fulfilling the research objectives and answering the question related to the research topic efficiently. The secondary data analysis process is utilized in describing and explaining the gathered data related to network optimization in learning and distributing intelligence among the network user. This gathered data helps to connect networks wirelessly with the help of electronics and software in the cognition network in observing the environment and drawing conclusions from the acquired data u that helps in evaluating alternatives effectively. This factor helps to provide level of freedom in choosing their action for controlling the expectation of requirement and goes into constructing technical systems for controlling the interfaces and managing the multi-intended distribution across the network [20]. The cognition network technology has to enable zero-touch development and operation in real-time performance improvement through self-learning in the scale and interaction with the environment.

This technology has to be combined in building cognition systems for working together in the operating process and participants in the low-level network tasks to end-to-end operation effectively. This factor helps to develop the decision-making process through smart data collection and exposure to develop the efficiency of data given network architecture and manage the life circle and integrate the training process that enhances pipelines properly.

RESULT AND DISCUSSION

Cognitive-based networks help to secure performative abilities within a secondary network with the utilisation of physical layer security. However, limitations regarding fading channels and power transmission can reduce optimisation. A cognitive "unmanned aerial vehicle (UAV)" is utilised to mitigate these issues through the exploitation of a highly flexible communication network, and establishing line-of-sight links [21]. On the other hand, robust optimisation of UAV trajectory over its transmitting power is considered for averaging the secrecy rate within the secondary network. Nonconvex problems are mitigated with an iterative algorithm of an S-Procedure while Bernstein-type inequalities are also proposed for cases of outage-constrained. In essence, security in communication can be achieved with adequate cognitive-based networks.

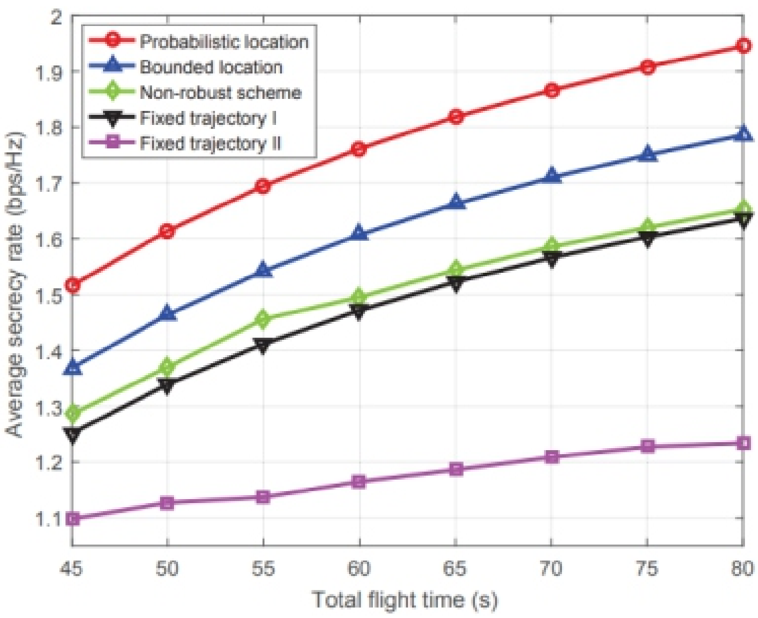

Figure 3: Average rate of secrecy versus total flight time in UAV network [21]

Network virtualization and softwarization are the new directions taken for evolving the network and gaining communicative efficiency. Scalability, reliability and flexibility are aimed to be incorporated with a cognition-based network. network function virtualization (NFV) and software-defined networks (SDN) are currently viewed as optimum solutions for establishing an efficient network [22]. SDN is capable of separating the control plane and the data plan with a defined interface for programming, providing an entire view of the network with a centralised control [22]. On the other hand, NFV operates by decoupling the network functions from the physical equipment with the aid of virtualisation technology [22]. These two helps to optimise the network by complementing each other, identified as key technologies for op[timing the 5G networks, used in various spaces such as cloud data centres, IoT, mobile-edge computing and cognition-based networks. Technological development is also witnessed regarding emotional awareness and the Internet of Medical Things (IoMT) which was especially effective during the covid-19 pandemic. The establishment of a cognitive model based on IMoT has helped during the pandemic by connecting and monitoring the network through information sharing, patient tracking, supervision, data collection and analysis, healthcare optimisation and so on [23]. Remote operations and decision-making in the medical field are enabled by the novel IMoT network, contributing to the development of emotion-aware services for healthcare. As a dynamic and cognitive-based technology, the development of a distributed and learning network can be established, for mitigating the challenges of remote operational processes.

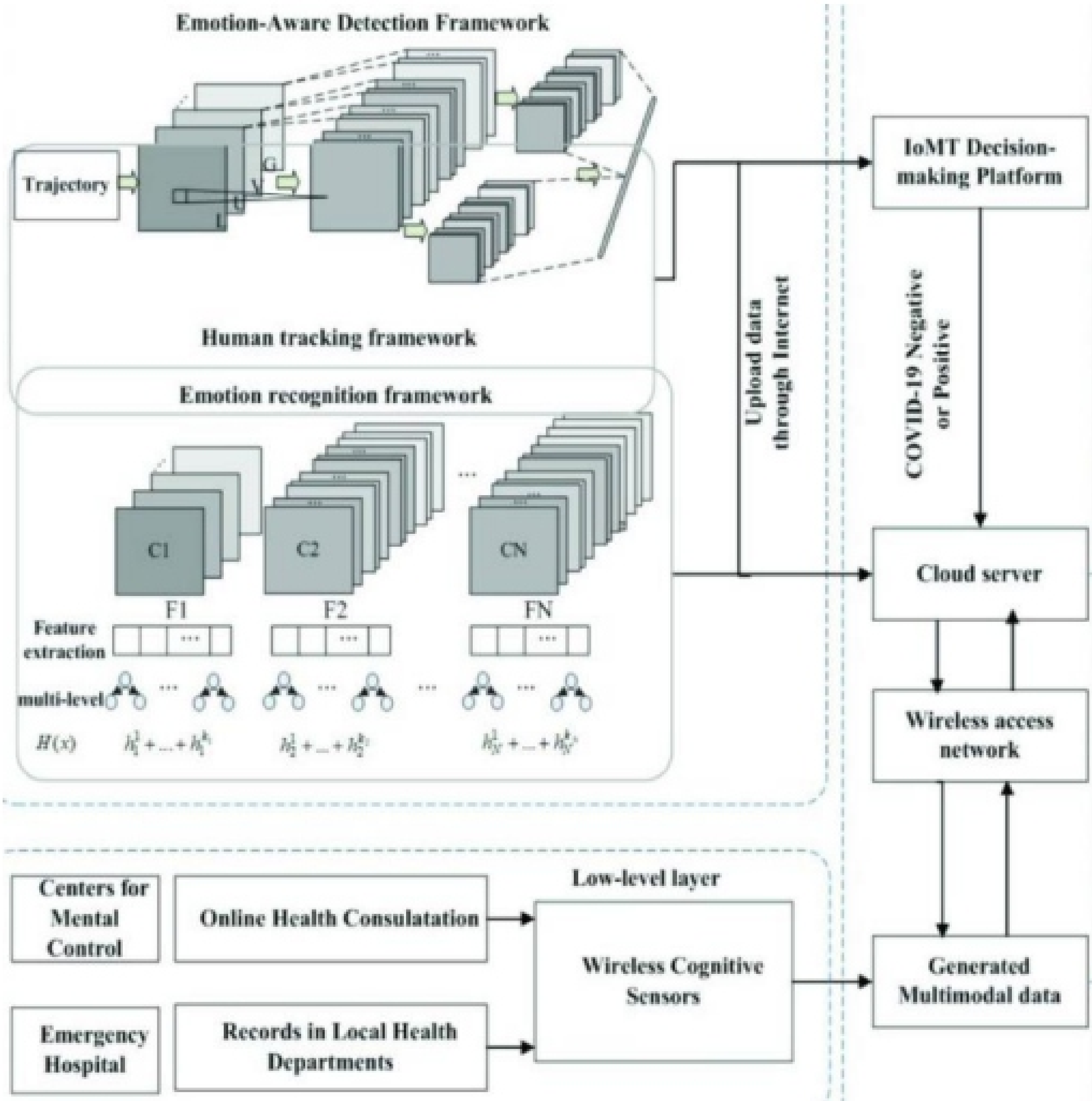

Figure 4: IMoT framework for a cognition-based, emotion-aware network in healthcare [23]

AI and machine learning currently hold significant importance in resolving complex challenges in various fields such as network distribution and communication. Implementation of AI and machine learning for NFV and SDN networks helps to establish a self-adaptive, self-configuring and self-managed network architecture, ensuring higher efficiency and scalability [24]. A Future Intelligent NEtwork-FINE is established based on a collaboration between SDN and NFV, consisting of different planes such as agent planes, intelligence planes and business planes. Each plane operates on different levels of the network, portraying cognitive networks, and accommodating both AI and ML. In essence, the compatibility between NFV and SDN confirms the scope for a wide-scale network that promotes transparency and efficiency yet adequate security to establish a reliable network framework.

Discussion

The potential for cognitive-based networks is recognised in the age of digital transformation, ensuring the mitigation of issues related to network scalability, reliability and operational optimisation. AI and machine learning technology have been identified as the most efficient tool for establishing a cognitive-based network for optimisation. Furthermore, using SDN and NFV conjointly within a network architecture with AI and ML helps to create a distributed and wide network range. NFV and SDN networks help to establish a self-adaptive, self-configuring and self-managed network architecture, ensuring higher efficiency and scalability with AI and ML [24]. Network optimisation is also considered based on the critical factors related to the security and accuracy of data transmission. It also helps to mice the network equipment for the reduction of network rollout of carbon emission and speeding the site acceptance for developing the subscriber's experience in a better way. In essence, the cognitive-based network establishes automation within the network architecture, enhancing communicative approaches. Distributed intelligence helps to apply smart algorithms of the network operations and procedures to distribute and centralise AI in developing the performance in the continuous learning process. Therefore, based on the above discussion, it can be stated that the development of a 5G network with SDN and NFV and AI and ML algorithms can establish a beneficial, scalable, adaptable and efficient network with high optimisation.

CONCLUSION

The prospect of network optimisation enables the network to provide maximum potential for scalability, transparency, adaptability and security during the management of communication. In essence, the optimisation of networks based on cognitive designs and AI technology helps in creating a learning and distributed intelligence network that is effective and operational for different industrial sectors. Cognitive-based automation for network optimisation enhances performance ability with the application of smart algorithms based on machine learning and artificial intelligence. Development of the 5G network is also identified as one of the potential uses of cognitive-based networks that helps to maintain secure and efficient communication services for the users. SDN and NFV network models are considered to be the most efficient and effective network frameworks, currently capable of mitigating the challenges of expansive and dynamic network circles, both regionally and globally. As the current cellular network is designed to serve a small number of users at a high bit rate with the help of downlinks that can create challenges in the massive access, safe expansion of the current network with cognitive-based optimisation can elevate the experience of users. Therefore, a learning and distributed intelligence model for network optimization is possible with a cognitive-based approach, ensuring that security and operational efficiency are maintained with the capacity to expand and accommodate the growing rate of users effectively.

REFERENCES

[1] Wan, S., Gu, Z. and Ni, Q., 2020. Cognition computing and wireless communications on the edge for healthcare service robots. Computer Communications, 149, pp.99-106.

[2] Srivastava, A., Gupta, M.S. and Kaur, G., 2020. Energy efficient transmission trends towards future green cognition radio networks (5G): Progress, taxonomy and open challenges. Journal of Network and Computer Applications, 168, p.102760.

[3] Xu, X., Li, H., Xu, W., Liu, Z., Yao, L. and Dai, F., 2021. Artificial intelligence for edge service optimization in internet of vehicles: A survey. Tsinghua Science and Technology, 27(2), pp.270-287.

[4] Qadir, Z., Ullah, F., Munawar, H.S. and Al-Turjman, F., 2021. Addressing disasters in smart cities

through UAVs path planning and 5G communications: A systematic review. Computer Communications, 168, pp.114-135.
[5] Curran, J., Parry, G.D., Hardy, G.E., Darling, J., Mason, A.M. and Chambers, E., 2019. How does therapy harm? A model of adverse process using task analysis in the meta-synthesis of service users' experience. Frontiers in psychology, 10, p.347.
[6] Helo, P. and Hao, Y., 2022. Artificial intelligence in operations management and supply chain management: An exploratory case study. Production Planning & Control, 33(16), pp.1573-1590.
[7] Li, Z., Bahramirad, S., Paaso, A., Yan, M. and Shahidehpour, M., 2019. Blockchain for decentralized transactive energy management system in networked microgrids. The Electricity Journal, 32(4), pp.58-72.
[8] Gures, E., Shayea, I., Alhammadi, A., Ergen, M. and Mohamad, H., 2020. A comprehensive survey on mobility management in 5g heterogeneous networks: Architectures, challenges and solutions. IEEE Access, 8, pp.195883-195913.
[9] Statista, 2022a. Digital population across India as of February 2022(in millions). Available at:https://www.statista.com/statistics/309866/india-digital-population-by-type/ [Accessed on:25th December 2022]
[10] Khan, S.A., Shayea, I., Ergen, M. and Mohamad, H., 2022. Handover management over dual connectivity in 5G technology with future ultra-dense mobile heterogeneous networks: A review. Engineering Science and Technology, an International Journal, p.101172.
[11] Wei, Y., Peng, M. and Liu, Y., 2020. Intent-based networks for 6G: Insights and challenges. Digital Communications and Networks, 6(3), pp.270-280.
[12] Almasan, P., Suárez-Varela, J., Rusek, K., Barlet-Ros, P. and Cabellos-Aparicio, A., 2022. Deep reinforcement learning meets graph neural networks: Exploring a routing optimization use case. Computer Communications, 196, pp.184-194.
[13] Alonso, R.S., Sittón-Candanedo, I., Casado-Vara, R., Prieto, J. and Corchado, J.M., 2020. Deep reinforcement learning for the management of software-defined networks and network function virtualization in an edge-IoT architecture. Sustainability, 12(14), p.5706.
[14] Statista, 2022a. Digital population across India as of February 2022(in millions). Available at:https://www.statista.com/statistics/309866/india-digital-po-pulation-by-type/ [Accessed on:25th December 2022]
[15] Anand, V, 2021.Upcoming telecom trends in India: How operators should gear for the new changes. Available at:https://telecom.economictimes.indiatimes.com/news/upcoming-telecom-trends-in-india-how-operators-should-gear-for-the-new-changes/856547290 [Accessed on:28th December 2022]
[16] Ericsson, 2021. Network optimization. Available at:https://www.ericsson.com/en/managed-services/network-optimization [Accessed on:27th December 2022]
[17] Albreem, M.A., Sheikh, A.M., Alsharif, M.H., Jusoh, M. and Yasin, M.N.M., 2021. Green Internet of Things (GIoT): applications, practices, awareness, and challenges. IEEE Access, 9, pp.38833-38858.
[18] Etemadi, M., Abkenar, S.B., Ahmadzadeh, A., Kashani, M.H., Asghari, P., Akbari, M. and Mahdipour, E., 2022. A systematic review of healthcare recommender systems: Open issues, challenges, and techniques. Expert Systems with Applications, p.118823.
[19] Ghaffar, Z., Alshahrani, A., Fayaz, M., Alghamdi, A.M. and Gwak, J., 2021. A topical review on machine learning, software defined networking, internet of things applications: Research limitations and challenges. Electronics, 10(8), p.880.
[20] Demertzis, K., Tsiknas, K., Takezis, D., Skianis, C. and Iliadis, L., 2021. Darknet traffic big-data

analysis and network management for real-time automating of the malicious intent detection process by a weight agnostic neural networks framework. Electronics, 10(7), p.781.
[21] Y. Zhou, F. Zhou, H. Zhou, D. W. K. Ng and R. Q. Hu, "Robust Trajectory and Transmit Power Optimization for Secure UAV-Enabled Cognitive Radio Networks," in IEEE Transactions on Communications, vol. 68, no. 7, pp. 4022-4034, July 2020, doi: 10.1109/TCOMM.2020.2979977.
[22] D. S. L. Wei, K. Xue, R. Bruschi and S. Schmid, "Guest Editorial Leveraging Machine Learning in SDN/NFV-Based Networks," in IEEE Journal on Selected Areas in Communications, vol. 38, no. 2, pp. 245-247, Feb. 2020, doi: 10.1109/JSAC.2019.2959197.
[23] T. Zhang, M. Liu, T. Yuan and N. Al-Nabhan, "Emotion-Aware and Intelligent Internet of Medical Things Toward Emotion Recognition During COVID-19 Pandemic," in IEEE Internet of Things Journal, vol. 8, no. 21, pp. 16002-16013, 1 Nov.1, 2021, doi: 10.1109/JIOT.2020.3038631.
[24] A. Gebremariam, M. Usman and M. Qaraqe, "Applications of Artificial Intelligence and Machine Learning in the Area of SDN and NFV: A Survey," 2019 16th International Multi-Conference on Systems, Signals & Devices (SSD), 2019, pp. 545-549, doi: 10.1109/SSD.2019.8893244.

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