COGNITIVE ROBOTICS IN ARTIFICIAL INTELLIGENCE

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***Abstract*—The following report is a systematized review of the Cognitive robotics in Artificial Intelligence. The cognitive robotics are structures that exploit the physical shapes of robotics and have the ability to think and reason out like human beings. The paper will focus on the aspect how the Robots uses the Artificial intelligence, the science of making computers to perform duties of human beings, such as reasoning, learning, and problem solving based on human integrity. This makes robots more of human beings. Therefore, in the excerpt, a detailed discussion will be outlined on various fields where robots have outperformed human beings.**

***Keywords*— Artificial Intelligence; Mechanics; Machine Intelligence; Cognitive Robotics; Linguistics; Traffic and Vehicles; Programming and Heuristic;**

I. INTRODUCTION (*Heading 1*)

As mentioned earlier, cognitive robotics is a type of artificially installed thinking ability on various bodies which takes in the physical shape of the robots. Robotics makes use of Artificial intelligence [1]. Artificial intelligence (AI) is defined as a science of making computers performs duties like reasoning, learning, and problem solving that humans use their intelligence to perform. According to various scientific discussions, it is evident that Robotics and Artificial Intelligence have a long history of interaction [15].

Therefore, this article focuses on the application of cognitive intelligence in robotics and how Artificial Intelligence has played a role in Robots in taking over human tasks over the years. The technology behind Artificial Intelligences covers a wider scope of studies. Some of the most common fields in this technology include Biological Science, Computer Science, Linguistics, psychology engineering, and mathematics. Also, the discussion will incorporate ancient Greek philosophies and various researchers such as The Syllogistic of Aristotle.

As a science, Cognitive robotics borrows the concepts of various disciplines that base their research on adaptive robotics, cognitive science, and artificial intelligence. In most cases, it applies the biological models based on cognition [2]. It is necessary for a robotic agent to deal with rich and non-structured environments which are occupied by objects that move and mingle with other agents in reality [16]. To move and work appropriately, a robot is required to understand the perceptions of the environment indulgent in the perspective of Artificial Intelligence, which involves a generation composed of the sophisticated declarative description of the supposed world.

It requires bottom-up data-driven procedures that associates date coming out from the vision system and the symbolic knowledge representation structures together with the top-down procedures that employees the high-level information in driving and further interpretation of the scene when coming up with such description [17]. Also, it is necessary to endow a robot with discerning reasoning capabilities to enable them to infer, track, classify and anticipate in the characters of agents and objects around them. The capabilities necessitate the essence of core representations of the environment that is firmly anchored to the input signals emitted by sensors. The symbolic meaning behind the robot's reasoning system has its roots associated to 'sensorimotor' mechanisms.

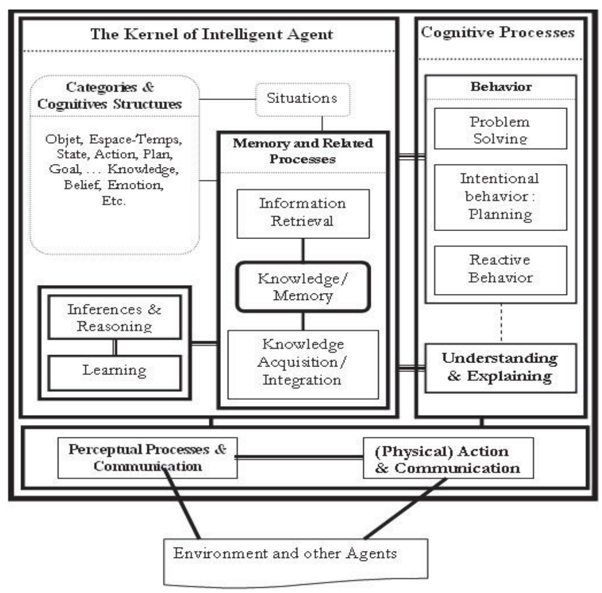

Figure 1: Artificial intelligence and Cognitive Process

II. LITERATURE REVIEW

HISTORY OF ARTIFICIAL INTELLIGENCE (AI)

Innovation has been utilized for quite a while by individuals to demonstrate on how verifiable and efficient technology has been. This is apparent from the antiquated Egypt, and Greece where these exercises were seen. The new innovation has been utilized to make canny operators. Some of these operators incorporate power through pressure, multi-dimensional images, simple and advanced PCs and phone exchanging frameworks. They are all mind demonstrating systems [14]. As expressed by Hobbes 1588-1679, who is alluded to be the Grandfather of AI, believing is a representative thinking. Descartes and his colleagues who were pioneers in the mind theory built up this thought that has always assisted over the years [13]. At the period when PCs were later created, they made the idea of emblematic operations more concrete.

The Analytical Engine was the first computer that was designed by Babbage (1912-1954) with a lot of work on computation following in the 20th century. Also, several models of machines were proposed such as Turing machine by Alan (1912-1954) [11]. Some of the calculations in robotics such as the elementary calculations are applied in path planning and mobile robot navigation [12]. For instance, what path can be taken by a robot to move from an original position to another point that is 1 meter away or at an elevation of 45 degrees to the right? Or, in a case where the robot is to follow a series of goal position, how can it find its way at a minimum deviation in both steering and speed? Based on these calculations, it makes it easy to use the final results in creating the control on inputs for robot drive systems. The system is always made up of values such as wheel rotation, steering angles, and motor velocity among others.

Aggregate movement of an arrangement of particles in mechanical technology is vital, and movement of individual particles isn't more often than not of intrigue. It is an inflexible body which can't be contorted [11]. Likewise, it is a collection of particles with a settled separation between each two particles that pays a little heed to any developments of the body or powers applied on their structure. In this way, if p and q speak to two focuses on an unbending body, at that point, p and q must fulfill the condition beneath when the body is in movement.

$$\mathbf{KP(t)-q(t)k=kp\ (0)-q(0)k=\ constant.}$$

The distance between any two particles is always fixed every time. It means, therefore, that is axis is rotated at a unit velocity ω for given units of time θ, then net rotation is given by;

$$\mathbf{R(\omega,\theta) = e^{\omega\theta}}$$

The advanced history of AI started with the improvement of stored program gadgets PCs [6]. Portrayal of the learning expected to tackle different issues was the real test, and between the 1970s, a characteristic dialect understanding framework was built through in constrained spaces.

During the period when the genuine PCs were made, AI programs were among the primary applications. Samuel assembled checkers programs in 1952, and they prompted the execution of the play checkers [9]. A Logic Theorist, a program that finds proofs in propositional rationale was worked by Newell and Simon. The art of neural systems lessened for a long time after the book written in 1968 by Minsky and Papert, which showed that the portrayals were insufficient for astute activity. Representation of the information expected to take care of all rising issues was the essential component between the 1970s and a characteristic dialect understanding framework was worked through in constrained areas [10]. With time, master frameworks were worked out in the 1980s. The main aim was to utilized to catch the learning of the specialists in a few spaces to empower PCs to lead scholarly obligations. In the 1980s, AI cognition evolved to a noticeably prominent concept in dialects like Prolog that was created by in 1996. Most disciplines and sub-disciplines of AI grew incredibly in the 2000s. Some of its sub-branches incorporate recognition, probabilistic, and choice [8]. As indicated by Eric Horvitz, there will be no peril as the engineers of the machines and frameworks will be proactive and guarantee that they are cautious on how they field AI frameworks. Further, the engineers will get staggering advantages from the knowledge of the machines in all parts of life extending from science to drug to instruction to financial matters to our day by day life [9].

In the field of pharmaceutical, understudies can be prepared utilizing AI, and it likewise helps in Diagnosis. Advances in AI will be a huge key in introducing another time of plenitude, where there will be a lot of nourishment, water, and devices for all people to utilize [6]. The production of super-smart PCs is a fantastic thought if there are carefulness and protections to guarantee that machines don't outperform human control and don't represent a danger to individuals [7]. The machines are not nearly assuming control, is essentially theory and a whiff of insanity. Machine insight has turned into a typical thing in life [17]. These days, PCs fly planes and drive autos [7]. New stories are made by PCs without human intercession.

According to Burghart, designing a system to teaming with the human demands cognitive stance is very demanding. Burghart also discussed on the requirement of control architecture to perform a range of cognitive functions. It is Alan C. Schultz and the research team at the Navy Center for Applied Research in AI (NCARAI), on the cognitively enhanced control that has inspired this research [18]. There has been a lot of exciting work of Alan C. Schultz and NCARAI research team exploring how cognitively improved control strengthen interaction with humans.

III. BACKGROUND ON ROBOT CONTROL ARCHITECTURES

Architecture is the arrangement of the control software for the robots. According to Bekey, architecture is the practical formation of the software of a robot. Its main goal is to give a direction in which sense, actions, and reasoning are organised, represented, and interrelated [6]. Bekey mentioned a connection between control and architecture as an architecture providing a principled way of how to organise the control system. However, other than providing structure, it creates constraints on solving the problems associated to control system. The common robot control architectures are divided into three groups. The first group is the Hierarchical or the Deliberative robots [5]. These types or robots use the SPA principle and are based on the sense-plan. Secondly are the Reactive robots that are very responsive to the outer environment and can counter any activity of another robot. The last group is the Hybrid control architecture robots. They are sourced from a combination of various traits put together in a single unit.

Deliberative or hierarchical control architectures require full environment information for their optimal functioning. The control is goal based. This kind of architectureis structured in layers. A robot with this type of architecture first senses the environment, then plan and finally executes actions [4]. Each step is performed at the corresponding segment. According to Arkin deliberative robotic systems have the following common characteristics [4]. They have hierarchical structure making it easy to identify the functionality of its subdivisions. Communication and control occur in a predictable and predetermined manner along the hierarchy with little movement [4]. Higher levels of the hierarchy provide sub-goals for lower secondary levels. Planning scope changes during descent in the hierarchy. At the lower levels, spatial considerations are plenty but with shorter time requirements making them rely heavily on the symbolic representation of world models [30].

IV. REACTIVE CONTROL ARCHITECTURES

Reactive control architectures use direct predefined reaction mapping from the sensor to the actuator [2, 3]. Reactive robotic systems consist of a collection of rules that map specific situations to related actions. Reactive robotic operations are very fast in motion and computations [2]. That is why for a real-worldsituation where the "reaction time" is a very important factor, a reactive robotic system is an answer. Reactive robotic systems have the following characteristics;

- These systems are based on the models of animal behavior.
- The control is stimulus-response based.
- The system has got behaviors consisting of a sensor-motor pair.
- Avoid the use of abstract representational knowledge.
- Purely reactive architecture cannot learn.

The best known reactive control architecture is the "Subsumption" that was introduced by Rodney Brooks about hybrid control architecture as stated in Kortenkamp [3]. It is right to call this approach P-SA, which means, the robot takes in planning based on original conditions and general knowledge, always represented as (P). It then executes this program by the help of a sensory act, represented as (SA) behaviors. Lastly, it can re-plan only in an unfortunate case where the reactive behaviors run out of basic installed solutions. The P-SA approach to robotics systems is referred to as the hybrid deliberative or reactive architecture [3]. Nowadays the robotic community believes that one way to mitigate the limitation and drawbacks found in deliberative and reactive architectures is to combine both architectures in a single Hybrid. The hybrid architecture uses deliberative planning to control the lower level of reactive components [16].

V. METHOD OF DATA COLLECTION

Themethods used included a survey of socially interactive robots and experiment reports. Recent efforts have made efforts to incorporate multitudes of AI skills like planning, learning and other high-level reasoning tasks for the application in a service robot [15, 19]. The combination of such reasoning tools results in exciting new possibilities, but the inter-changeability of different robotic platforms and reasoning tools is a minor issue in the project [2]. The Know-Rob framework has been one of the successful approaches in robotic platforms in giving different knowledge [28, 29]. The context is focused on inferring and accessing ontological knowledge required in executing vaguely specified tasks on-the-fly [2]. The approach has been viewed to be a success for different object manipulation tasks such as cooking [1]. But, it has less experimental character than ExpCog. For instance, its planning ontology and causal reasoning is fixed, which has always made it hard to experiment with different action calculi or the spatial calculi like OPRA and RCC [28]. It has a similar presentation of the framework in that it constitutes architectural knowledge for robots. However, it has a more cognitive motivated focus on human-robot interaction and action/plan learning and a little emphasis on the robotic experimental character frameworks.

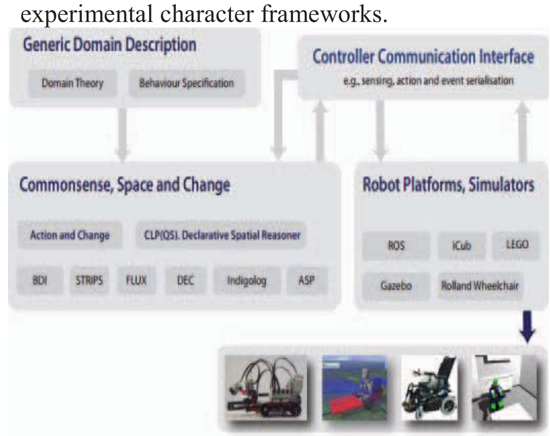

Figure 2. ExpCog – Conceptual Overview of Architecture

VI. RESULTS AND DISCUSSION

Robotic Expert System; The framework has been utilized as a part of doctor's facilities and it has a more elevated amount of knowledge than any medicinal professional when it comes to diagnosis. The framework improved the situation than any restorative understudy or rehearsing specialists. The framework's metaphysics just incorporated the microorganisms, manifestations conclusion and the treatment and did exclude the patients, demise recuperation and clinics other essential particulars. [27]. The system also made great improvements concerning data recordings on the care facilities as it had internality installed data record system of various clinical procedures and lab reports on various diagnoses [27]. Also, it minimised diagnosis errors associated with doctors due to the intentional neglect of duties or accidents.

AI in Expert systems; MYCIN was one of the principal master frameworks that were produced in 1974 and was utilized as a part of the analysis of related blood microscopic organisms and give proposals of the medications [20]. The framework improved the situation than any medicinal understudy or honing specialists. Its metaphysics just incorporated the microorganisms, symptom indications and the treatment [18]. Be that as it may, it did exclude the healing centers, patients, demise recuperation and different particulars. relevant to the said field. The system could carry out blood test among various samples and give accurate results according to the symptoms and possible infection that is likely to be experienced if immediate treatment is not initiated. This improved lab test activities due to its reliable and more accurate results [18].

Heuristic Classification; In this system, a few sources are utilized to join data in one of the settled classifications like prompting regardless of whether to acknowledge a proposed buy of a MasterCard. The data about the proprietor and his or her reimbursement record is accessible, and it can be resolved whether the individual has beforehand defaulted. Counterfeit consciousness makes this conceivable.

Handwriting Recognition; AI is broadly utilized in the transformation of human handwriting into a content that would then be able to be altered when put into a PC or a tablet. For example, Stylus empowers composition of writings on the PC screen, and the product for perceiving penmanship is then used to transform it into content [21]. Generally, it is connected in schools where an instructor can change his or her written work into content by utilizing a keen board, making it conceivable to check a page, and the OCR programming can change over it to editable content by perceiving and changing over the letter from the first shape to ASCII content [20].

Artificial Intelligence, also referred to as Counterfeit consciousness is likewise connected inside the field of education. At first, PCs have been creating baffling outcomes in the instruction framework [26]. Nonetheless, the current research and flow of studies towards the inquiry of knowledge about AI has expedited a positive effect on the applications being used [22]. For example, the presentation of Intelligent Computer-Assisted Instruction (ICAI) frameworks utilized as a part of educating and coaching a few subjects [23]. In the instruction framework, likewise the master frameworks are being utilized to help with the instructive conclusion and appraisal.

Driverless Cars; Numerous miss-chances and accidents that happen on our streets and roads at a nearly 90% basis are because of human mistake. Computerized reasoning application can prompt creating self-driving autos since people are getting to be noticeably lousy drivers and extremely reckless on streets. This may help lessen the quantity of faults that happen on streets because of human mistake [20]. This is influenced conceivable by enabling coolly intelligent robots to do the driving in spite of the fact that it is exceptionally unexpected that the robots must be modified to drive more like people. The innovation to create electric autos by Google X is a piece of the undertaking bound to lessen the quantity of the street miss-chances that are an after effect of heedless driving [24]. The vehicles are alluded to as Google feline, and they have the product introduced in the autos called Google Chauffeur. In the United States, enactment has been passed in four expresses that permit driverless autos on open streets. A few calculations are done on remote PC cultivates that would empower the framework to work [23]. The new model delivered by Google is a driverless auto, without a controlling steer-wheel, gas pedal, and is 100 % self-ruling.

The upsides of the Self-driving autos are a few. The impacts between the autos infrequently happen, when they happen they are not lethal [25]. There are just minor wounds that might be endured if there should arise an occurrence of the crash. This, along these lines, implies that there is the reduction in the quantity of individuals who die or get hurt because of the road accidents. The more astute vehicles make transportation more secure and more effective as the autos can drive nearer to each other henceforth using 80 % to 90 % of all the space that the human drivers leave among them and help shape rapid guards on the roads [23]. The robots respond speedier than people maintaining a strategic distance from mishaps consequently sparing a huge number of lives. Vehicles will be a mutual asset that one can access whenever just by tapping a Smartphone from wherever with the self-governing auto shows up and prepared to offer a drive. This is one of the ways that innovation can improve transportation and more effective for general public domain. [24]. However, some limitation such as the inability to identify and recognise traffic police signals and minor potholes on roads may lead to mistakes. But these cannot lead to massive accidents.

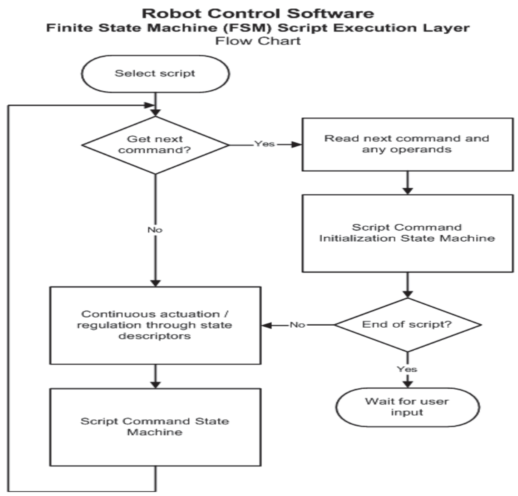

Fig 3. Robot control software

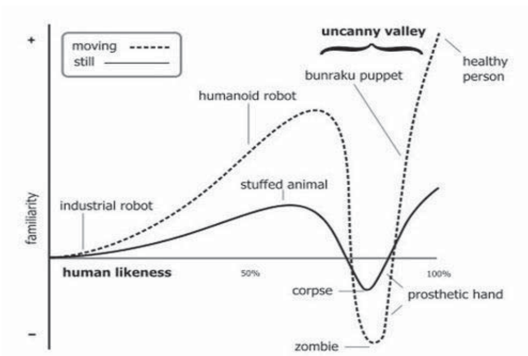

Figure 4. Robots and the human's flow chat diagram

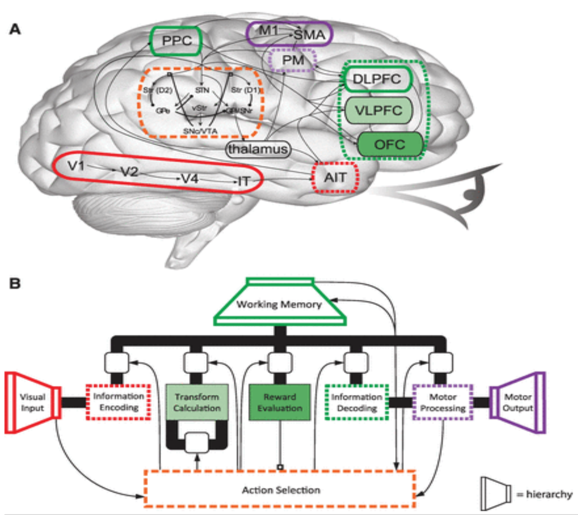

Fig 5 .similarity between the robotics and the human brain

VII. CONCLUSION

In summary, Mechanical autonomy has taken the consideration of awesome personalities and essential interest of people. Many controls are canvassed in the investigation of robots, and the robots are exceptionally inventive. Despite the fact that there are many difficulties in the improvement of reliability of the cars and solving the legal and liability issues, these are constraints that can be tended to. When they are settled, transport will be simple and exceptionally productive, and the quantity of mishaps on streets will be decreased. Likewise, the most recent model of telephones has a worked in program that has made it feasible for the proprietors to make gets and discover the climate conditions through voice or discourse acknowledgment.

VIII. RECOMMENDATIONS

Software makes it possible to recognize the demarcation traffic lanes on the roads, and the algorithms used is unique, and it uses three different webcams. The software can calculate the distance between the paths and probability of how close car's wheels to traffic lanes. There is also master software that can collect data from all the other software components and can compute decisions of the vehicle on the road, and it is also able to synchronize all the software components and control all the other software components [15]. Through the use of deep learning and sensor fusion, it is essential to building a complete three-dimensional map of everything that is going on around the vehicle, and this empowers the car to make better decisions than a human driver. In addition, it is important that driverless cars be introduced into the international markets to improve the safety of road transport. The machine is more efficient than human beings, giving fewer errors and making tasks easier and efficient. It is therefore high time machines are taken to replace a human being in different aspects to improve performance in various facilities.

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