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CLOUD ROBOTICS: A SURVEY

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ABSTRACT

The purpose of this paper is to give a deep view on 'Cloud Robotics'. some of the important points are covered in this paper like, benefits of this technology and what is driving this research. software framework is also presented to highlights the technical developments in cloud computing. It currently enables cloud robotics for mobile robots .The main dependence of cloud robotics is on the cloud computing architecture. The information sharing capabilities and computations can be increased with the help of cloud robotic architecture. In the cloud robotic architecture an ad-hoc cloud is formed by machine to machine (M2M) communications among the robot participants. Machine to Machine communications (M2C) enable the infrastructure cloud ..In this we discuss the potential benefits of cloud (I)big data: for fetching the images and maps etc from the libraries;(II) Cloud Computing: provide parallel grid computing for statistical analysis ,learning and motion planning;(III)Collective Robot Learning: provide robots control policies, and outcomes; and(IV) Human Computation: provide human skills for analyzing images and video, classification, learning, and error recovery with the use of crowd sourcing.

Keywords: Big data in cloud, Cloud computing, collective robot learning, cloud technologies,

I. INTRODUCTION

The Cloud has a capability to enhance a broad range of robots and automation systems as illustrated in Fig. 1,.According to National Institute of Standards and Technology (NIST) Cloud can be defined as "a model which can be used for enabling ubiquitous, more expedient, afford on-demand access to network for a shared pool of configurable resources like servers, storage, networks and other applications. An example is the online word processing capabilities offered by Google Docs. One can send Microsoft Word documents over the Internet, but in Google the document and software does not reside locally. data and code is stored using remote server farms in the cloud with shared processors and memory. This is helpful for maintenance, outages, and software or hardware updates. The Cloud also facilitates the economies of scale and sharing of data across the applications and users. Cloud Robot and Automation systems can be broadly defined as: every robot or automation system that relies on either data or code from a network to support its operation, i.e., where in a single standalone system all sensing, computation, and memory is not integrated. This definition is intended to include future systems and many existing systems that involve networked teleportation or networked groups of mobile robots or warehouse robots as well advanced assembly lines, plants processing, and home automation systems, and systems with computation performed by human beings because of some factors like network latency, variable quality of service, and downtime, Cloud Robot often include some capacity for local processing that have low-latency responses and for those time periods where network access is unavailable or

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unreliable. This is not a binary definition; there are degrees to which any system will fit under this definition. Here we have a example of Google self-driving car that exempli fies the idea. In this indexes, maps and images are collected and updated by satellite, It also provide the Street view, and crowd sourcing from the Cloud that facilitate accurate localization

II. BIG DATA IN CLOUD

Today data is available in very huge quantity .Data is being collected at unprecedented scale in a broad range of application areas. Now a days, Decisions are made on the basis of data itself not on guess works or on painstakingly constructed models of reality. Such Big Data analysis now a days drives nearly every area of our modern society like mobile services, retail, manufacturing, financial services, life sciences, and physical sciences. Revolution in Scientific research has been made by Big Data. Today the Sloan Digital Sky Survey has become a central resource for astronomers all over the world. The area of Astronomy is being transformed from one where a larger Part of an astronomer's job was taking pictures of the sky to one where the database is maintained that already contained all the pictures so that they can take the required data from it and the astronomer's job is to find interesting objects and phenomena from the database. As big data store large amount of data, so managing of big data is very important. The synchronization of architecture of big data is very necessary to support the infrastructure of the organization. There are different fields where tshe data is sourced that can be disorganized and messy like information taken from machines or sensors and can be a large sources of public and private data. Previously, most of the companies were unable to either access or store these data and even the available tools could not manage the data in a reasonable amount of time. , the new Big Data technology improves performance, facilitates innovation in the products and services of business models, and provides decision making support . Big Data technology motive was to minimize the cost of hardware and processing and to check the value of Big Data before the commitment of important resources of the company. So if the Big data is managed properly then data can be easily accessible, more reliable, more secure, and more manageable. Hence, Big Data applications can be applied in number of complex scientific disciplines. It may be either a single or interdisciplinary that include atmospheric science, astronomy, medicine, biology etc. so a new data life cycle is proposed that uses the technologies and terminologies of Big Data for managing tools. With the development in the field of computing technology, large volumes of data can be managed without requiring supercomputers and high cost. For data management many tools and techniques are available that include Google Big Table, Simple DB, Not Only SQL (NoSQL), Data Stream Management System (DSMS), MemcacheDB, and Voldemort . However, companies should develop the special tools and technologies. These tools and techniques can store, access, and analyze large amounts of data in the real time because Big Data differs from the traditional data and cannot be stored in a one single machine. Furthermore, Big Data does not have the structure like the structure of old data. For managing Big Data, some of the most commonly used tools and techniques are Hadoop, MapReduce, and Big Table. In these new innovations we have redefined data management because they large amounts of data is processed effectively, efficiently, cost effectively, and in a timely manner. Hadoop and Map Reduce are the various projects/frameworks which are

related to and also suitable for the management and analysis of Big Data. Hadoop is written in Java language. Hadoop is a top-level Apache project which is started in 2006.

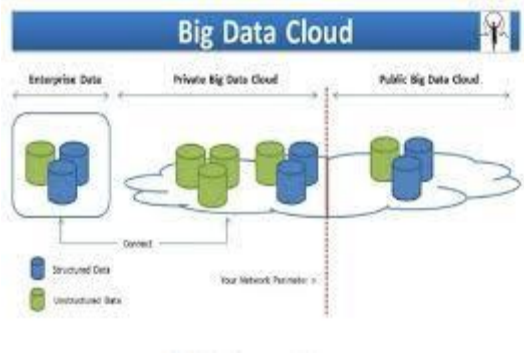

Fig.1 BIG DATA ON CLOUD

III. CLOUD COMPUTING

Now a days parallel computation is available on demand from commercial sources like Amazon's Elastic Compute Cloud, Google's Compute Engine, and Microsoft's Azure etc . For short-term computing tasks these systems give access to tens of thousands of remote processors . The services of these systems were originally used by the developers of web designers for web applications, but now these systems are used increasingly for scientific and technical high-performance computing(HPC) applications. Uncertainty is possible in sensing, models, and control is a central issue in robotics and automation. Such uncertainty can be modeled as perturbations in position, orientation, shape, and control. Cloud Computing is suitable for the analysis of sample-based Monte-Carlo analysis. For example, we can compute the outcomes of the cross-product of many possible perturbations in object and environment pose, shape, and robot response to sensors and commands , parallel Cloud Computing can be used . This idea is being explored more in the area of medicine and particle physics. we can use the Cloud-based sampling to compute robust grasps in the presence of shape uncertainty. Cloud Computing has potential to speed up many computationally-intensive robotics and automation systems applications such as robot navigation by performing SLAM in the and next-view planning for object recognition . Cloud-based formation control of ground robots has also been demonstrated .For optimal sampling-based action scheduling methods such as RRT*, Cloud Computing is useful to produce the graphs; it is also important to identify that these graphs can nurture rapidly so algorithms for graph diminution are needed to facilitate data transfer The Cloud also facilitates video and image investigation and mapping and for higher-ranking citizens recommend an architecture for efficiently planning the motion of new robot manipulators designed for bendable manufacturing floors in which the computation is split between the robot and the Cloud. It is important to acknowledge that the Cloud is prone to different quality of service and also the different network latency. Some applications are not time sensitive, such as de-cluttering a room or precomputing seize strategies or offline optimization of machine scheduling, but many applications have real-time demands and this is an active area of research.

IV. COLLECTIVE ROBOT LEARNING

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The Cloud provide the facility of sharing the data for robot learning by collecting the data from many instances of physical trials and environments. For example, robots and automation systems can share The initial and desired conditions, associated control policies and trajectories, can be shared by the robots and automation systems and also importantly the data on the resulting performance and outcomes. The "Lightning" framework, defines a framework for Collective Robot Learning . In this learning indexing trajectories from number of robots over many tasks and using Cloud Computing for parallel planning and for making trajectory adjustment .We can also expand Such systems to global networks to facilitate shared path planning that include traffic routing.

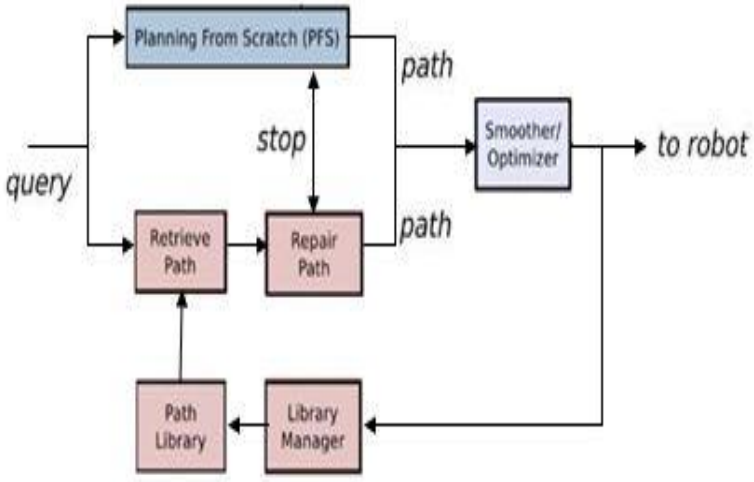

Fig 2. COLLECTIVE ROBOT LEARNING

For making the grasping possible, grasp stability of finger contacts can be learned from previous grasps on an object. Sharing of data through Collective Robot Learning can also be used to improve the capabilities of robots when we have limited computational resources. The My Robots project which is from Robot Shop also proposes a "social network" for the use of robots: "As we know the human beings benefit from socializing, collaborating and sharing, in the same way robots can also benefit from those interactions too when they share their sensor information and giving insight on their perspective of their current state". There are two databases named RoboEarth and RoboBrain databases which are designed to be updated with new information which will be collected from connected robots. The project named Robobrain "learns from the Internet resources which are publically available, computer simulations, and real-life robot trials." KIVA Systems ,for making the move pallets in warehouses uses hundreds of mobile platforms by using a local network to coordinate motion and update tracking data.

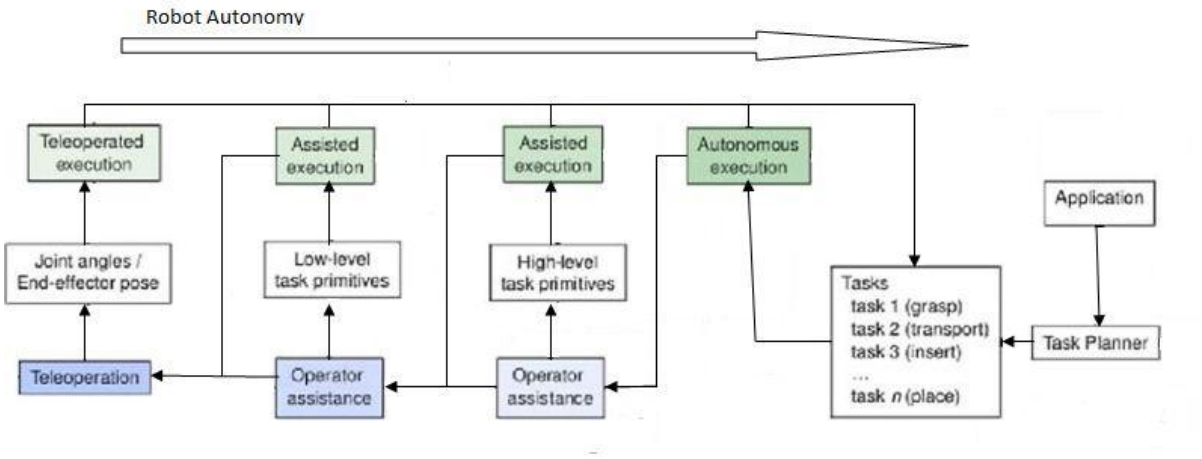

FIG. 3 LIGHTNING PATH PLANNING FRAMEWORK ARCHITECTURE.

V. CONCLUSION

The cloud robotics are dependent on cloud computing architecture. This helps to create an temporary cloud by the communication among the robots participants. It can be a machine to machine communication with the help of remote server ,data and code is stored in the cloud that have shared processors and memory .revolution in scientific research has been made by the big data. Big data handles a huge quantity of data in broad range of application areas. so different tools and techniques are used to manage the big data. Cloud computing is used to do parallel computations. Collective robot learning is used to collect the data from the many instances of physical trails and then provide the sharing of data for robot learning. This improves the capabilities of robots when we have limited computational resources.

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