Virtual Reality (VR) & Artificial Intelligence (AI) in Businesses

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Abstract- **Virtual Reality (VR) is a rising innovation and is influencing different parts of the businesses. Artificial Intelligence (AI) is booming in a number of fields including science, engineering, banking and business, etc. Along with AI, now VR is also changing the business strategies and trying to reshape the businesses. It becomes now crucial to determine the application area of business wherein VR/AI can be applied. New challenges and opportunities are waiting on combining VR and AI in different businesses. This paper considers the impact of VR/AI in business. Basically the paper reviews the literature that published in connection with VR and AI and the impact of VR/AI on businesses. It discusses A VR system with perception-action loop.**

Index Terms- Artificial Intelligence (AI), Virtual Reality (VR), Artificial Intelligence in Business.

I. INTRODUCTION

The main purpose of AI is to create intelligent computer programs and making machines that are capable of learning. Now AI grabbed numerous fields including science, engineering, gaming, finance, banking etc. Basically AI makes a machine to think like human. It depends on the training data, historic data and the live data to learn [5].

VR is a promising and emerging field which is infiltrating the businesses. It actually is reshaping the business operations. VR finds applications including gaming, design, technology, education, social media, security, learning environments, image processing, retail, entertainment, sport technology, medical field etc [5].

Both VR and AI are influencing the businesses. The rest of the paper reviews different research papers in connection with VR and AI in businesses.

II. REVIEW

The system design [6] is shown in Fig. 1 below. It is comprised of three sub-modules: i] a VR module ii] a scene module iii] a Physics-based Engine Module. A VR Module collects data about the real world agent (e.g. body pose, head pose, hand pose), and displays the virtual environment to the agent. A Scene Module provides 3D data about the virtual scene. A Physics-based Engine Module consolidates all the data, allowing the real world agent to interact with the virtual environment.

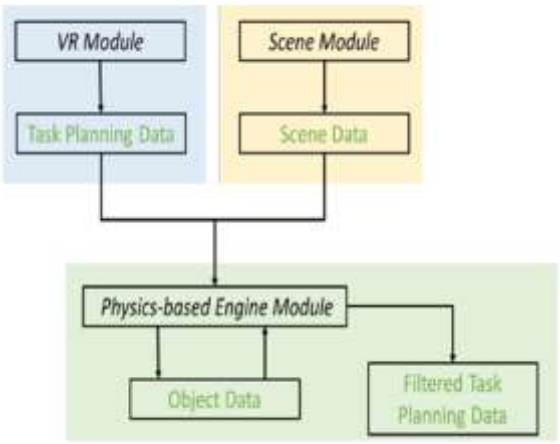

Fig. 1 System Design [6]

The paper [6], proposed a system such that dynamic 3D scene models are imported into a physics-based engine. Then it combined with a VR setup. Hence it allows human agent to interact with the virtual scene. A robust VR testing environment can be used in remote human-robot interaction experiments. It can also be used in remote evaluation for robotics competitions.

AR (Augmented reality) and VR show two ends of the spectrum. AR bases reality as the main focus and the virtual information is presented over the reality. VR bases virtual data as the main focus. In mixed reality, AR meets VR, by merging the physical and virtual information seamlessly [1].

The computational capacity of low-cost devices can be increased by shifting computational tasks from VR to cloud-fog servers. This scheme saves battery energy. For this reason, MEC (Mobile Edge Computing) will enable devices to access cloud/fog resources. For VR both radio access and computational resources must closer to VR users [1].

The authors [3] presented a novel method for the digital documentation. Particularly this work is focused on the digital documentation of cultural heritage. The proposed method is based on combining different techniques for data capture and processing and image analysis. This can be used to obtain 3D models from images and the texturing of these models. For generation of 3D models, authors rely on convergent photogrammetry to acquire information about the real objects. Authors also apply AI and computer vision techniques for further processing of all acquired data. Thus authors used reverse engineering technique to obtain digital documentation of cultural heritage from data and developed a novel method for digital documentation.

The 3 D interfaces and serious games are VR (Virtual Reality) systems. This is becoming common for the training of military force and emergency teams. The development of serious games should allow the addition of semantics to the virtual environment. Also it allows the modularization of the AI controlling the behaviors of non-playing characters.

In the paper [4], authors reported PRESTO (Plausible Representation of Emergency Scenarios for Training Operations) research project and focused ontology design activity performed. The main goal of this project is to realize a conceptual model that can be able to abstract the developers from the graphical and geometrical properties of the entities in the virtual reality, as well as the behavioral models associated to the non-playing characters. The proposed method is validated through real-world examples. The main objective of PRESTO research project is the creation of a system for the customization of VR based serious games scenarios. The merits of this system are the richness and easiness in defining the behaviour of artificial characters [4].

The current research focus of AI can be divided as: strong AI, weak AI and normal AI. I] Strong AI is to build systems that think or exceed human thinking or intelligence.

II] Weak AI is build AI systems without consideration of surpassing or equating to human thoughts.

III] Normal AI is to build hybrid systems capable of human reasoning but needing human interaction

The AI systems are developed by using audio recognition, visual recognition like humans.

Deep learning is becoming most popular process to achieve the end results. It uses training, historic and live data. Basically it is developed such that it constantly learns and stores information. Then the learnt patterns are matched, indexed and stored for future use. This can be used in games, education, decision making roles etc. Now combining VR and AI will lead to enhance the performance of applications such as filmmaking, education, healthcare, gaming etc. VR set can be useful for Medical students to practice simple to complex operations to reduce the overall risk. Here, AI can be used as a foundation for such applications. The big data learning will be crucial for both VR and AI learning process [5].

In recent years, VR has incorporated in a number of applications targeting physical and psychological conditions. The applications of VR include affective disorders, assessment and treatment of neurocognitive, assessment of attention, visuospatial abilities, navigation, memory etc. Actually the term VR- virtual reality does not limit the researcher to a particular configuration of hardware and software. VR is a development of simulations that make use of various combinations of interaction devices and sensory display systems. Many users of VR have opted for highly immersive experiences using more invasive head-mounted displays (HMDs) [7].

The paper [8] presented an analysis of comparative surveys. The paper discussed the use of hand gestures, gesture taxonomies, its representations and recognition techniques, software platforms and frameworks. It focused on three phases of hand gesture recognition. The three phases of hand gesture recognition are- i] detection, ii] tracking and iii] recognition.

The paper also discussed the applications of hand gestures recognition. It discussed an analysis of existing literature of gesture recognition systems for human computer interaction. It suggested some advancement to improve the present hand gesture recognition systems [8].

III. A VR SYSTEM

A. Perception-Action Loop

In day to day life, action is coupled with changes in sensory input. This is in the form of action loop i.e. perception. A schematic of this perception-action loop is shown in Fig. 2. Human brain basically adapts to such coupling by prediction. It gives quick response to changing events [2].

B. A VR system

A VR system is shown in Fig. 3. As shown in figure, the control software is the core of the system. This enables the scene to be displayed on display devices eg. visual interfaces and the haptic. It controls the communication between the interface layer and the virtual world. The control software also communicates with the outside world with the help of internet.

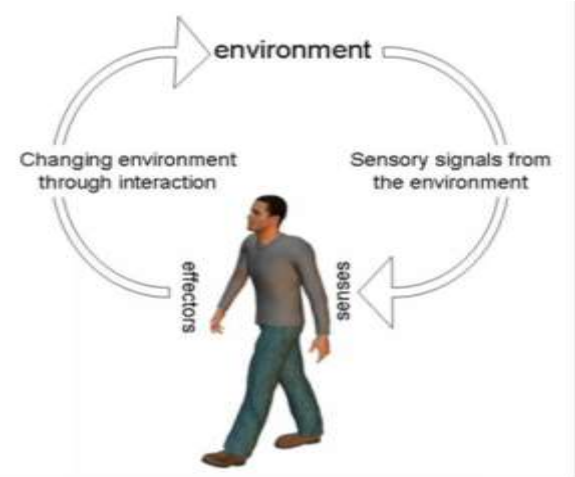

Fig. 2 Perception-action loop [2]

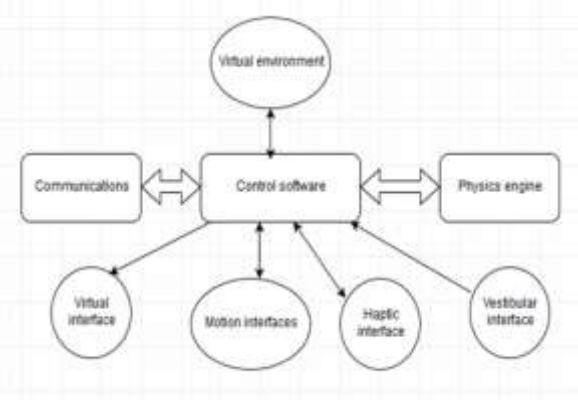

Fig. 3 View of a VR system [2]

The virtual environment module comprised of the actual world model along with the entities within it. This representation includes appearance and state and position information. The entities can be static objects or dynamic entities. Dynamic entities may be moving objects. These entities must be updated within the virtual environment. The virtual environment module is a database. It stores the position, form, and other properties of all parts of the virtual world.

A realistic simulation can be obtained with the help of Physics engine. It concerns with the motion and interaction of dynamic objects.

IV. CONCLUSION

The scope of VR and AI will be widening in forthcoming years. This paper discussed AI and VR concept. It reviewed different research papers published in connection with applications of VR and AI. This paper also focused on the possible businesses that are affecting by VR and AI including cultural heritage preservation, gesture recognition, Medical education VR set, gaming, filmmaking etc. A VR system is also discussed with perception-action loop.

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