MIXED REALITY TECHNOLOGY-BASED INDUSTRIAL ROBOT TRAINING PLATFORM

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Abstract: Virtual Environment is a mixture of the real and digital worlds that enables users to interact with computers and their environments in novel ways. For robotics research & innovation, Multimedia can be a beneficial tool. This Research Work examines how Virtual Environment may bridge that gap between modeling and deployment by allowing techniques to be developed and tested on a mixture of virtual elements including robots, sensors, and individuals. Commercial Robot Training depending on Mixed Reality and Virtual Worlds is created in this research article. This technology will help in gaining in instinctively communicating with technologies and their environments. As a result, the content of practiced in various will naturally develop, students' "interest towards knowledge will be aroused, and students' wide range of operating competence will be improved. Experienced instructors will employ this program in the country, and they will be able to support vocational qualifications using a platform that combines virtual server models and real-world environments.

Keywords: Industrial Robots, Mixed Reality, Robotics, Virtual Simulation, Virtual Reality.

1. INTRODUCTION

Industrial robot education has progressed in phases. Robotics engineering has become a major at a number of colleges. The challenge is that there are a variety of multiple business machine products available in the market in the neighborhood. There are also several model variants there in integration industry, and indeed the cost of purchasing a dependable robotic vehicle is high. On the other extreme, incorrect techniques during industry attachment might lead to significant disasters. A set of highly industrialized technology schools has already been built using VR and MR technology. It also dealt with the issue of a scarce resources. There is a scarcity of educational resources due to the high cost of autonomous production fitness training. as well as potential security considerations [1].

The most prevalent modeling environment training technologies are analogue motion controls and mobile version. There are two factors to take into account. One issue seems to be that they have been unable to meet the project resources of multi-person educational environments. The VR Website builder utilized in this article can address this by having a large number of servers plus throughput. It's ideal for synchronized learning among big groups. The second concern is that every real statistics is supplied, which translates to a lack of substance in the process of learning. As a result, immediately sensing the interconnected environment's restrictions on the workplace robot's size and suggestions for future work characteristics becomes unachievable. As a conclusion, the connection scheme's structure is picked. This project designed a program based on MR technique to address this issue by providing the operator to immediately perceive the incorporated solution's anticipated effect in a continuous manufacturing environment [2].

1.1. *Virtual Reality Based Web Simulation Platform:*

Web-based VR (Web-VR) has developed as an organisational requirements for creating interactive and immersive VR apps by persons with little to no programming knowledge.

1.1.1. Virtual Reality Introduction:

VR is a computer generated world containing plausible visuals and artifacts that gives the customer the sensation of being entirely absorbed in their circumstances. As described in Fig 1, this world is experienced without the use of a Virtual Reality headgear or helmet. Augmented reality may have been used to immerse oneself in online games as if we have been one of the protagonists, to learn how to perform surgical treatment, and to enhance the quality of athletics training in order to improve performance.

Figure 1: Virtual Reality

Notwithstanding the fact that it appears to be quite contemporary, it has a far actual history than we may suppose. Format was originally [3], a machine with the a built-in couch that played 3D movies, exhaled smells, and caused vibrations to make the event as accurate as possible, was largely viewed as being one of the earliest Interactive Virtual devices. The proposal was initially introduced in the mid-1950s. Considering computer and design improvements, neither device and interaction design slowly transformed throughout period.

1.1.2. Solution Introduction:

This study presents a virtual reality-based web simulation platform. Thi is based on B/S construction and works with a wide range of student terminal devices. The webbrowser on the terminal for students can access all of the platform's training programs [4]. It makes it easy for students to use Internet terminal equipment to access the training platform as shown in Figure 2.

Figure 2: Web Simulation Platforms Interface

1.1.3. Interactive Mode:

The rendering effect is real and real-size data and methods of operation are used in many robotic systems equipment versions. Users can customize the robot in another one of two ways: intuitively either through program, as is the case in real life as shown in Figure 3.

Figure 3: Two operation modes of the teaching pendant.

Learners are required to acquire technology for a multitude of integrated applications. After choosing the optimum equipment, the industrial automation model will emerge in the manufacturing environment, and other activities can resume. During in the training stage, the system would give information and keep track of when trainees do things like causing the robot to do anything outside its range of operation, collide with the surrounding or product, or make code development mistakes, as illustrated in the figure 4.

Figure 4: Prompt for incorrect operation.

1.1.4. Practical Training Tasks:

When evaluating each project, customers should pay special attention to the working process of something like the real systems engineering project. Error operations will indeed be recalled and reported as soon as feasible. Each stage offers three possibilities, and each blunder may cost you 10 products. Before going onto another operation phase, all procedures can indeed be adjusted, giving for further opportunities for advancement. A person may repeat this experiment if participants make five inaccuracies. Students can move on to a new project after carrying out the project assignment. As illustrated in the figure 5, the four test items established in this publication's network simulator are holding, welders, unloading, and discharging.

Figure 5: Training task scenario.

1.2. Real-world Interaction System Based on Mixed Reality:

The traditional and cyber worlds are intermingled in a mixed-reality environment. Because to improvements in graphics processor speed, object tracking, and other technologies, what was previously only imaginable in our imaginations in regards of the relationship between fictitious items and realities is now conceivable.

1.2.1. Introduction to Mixed Reality-System:

In MR, real-world and computational aspects are combined together. In mixed reality, you contact with and manage both physical and digital worlds and surroundings including next sensing and camera technologies, as showed in Figure 6. You can watch and submerge yourself in the world around you because engaging with a simulated space with your own hand without ever removing your headset. It allows you to also have one foot or hand there in real world and another in an imaginary one, destroying basic concepts including real and imaginary and delivering an experience which might change how you game and work all the time.

Figure 6: Mixed Reality

Virtual Environment is a sort of machine vision in which virtual representations are placed directly on real - world environments. It also uses movement, sight, gaze, and many other means to engage with holograms. The rendering effect tries to recreate as nearly as practicable how people come into contact with the real environment. Inside this system, Windows Corporation's Hologram is the preferred endpoint hardware. Microsoft's HoloLens is a handheld graphical supercomputer that can be donned on the head. Just in front of the device houses fingerprint hardware like as CPUs, photographers, and small - angle x devices. By beaming pictures directly into in the human eye, segments and sub devices may generate holographic images. Users could engage without digital holograms and used the HoloLens' gesture participants were exposed [6].

Figure 7: In a Continuous Manufacturing Setting, Virtual Instrument Mapping

The system's model positioning capability could position the fully virtualized object in the environment on the genuine item's surface, strengthening the system's credibility. It takes advantage of something like the smartphone's one-of-a-kind spatial mapping capability. After the able to fully experience feature is turned on, this system will continuously scan the environmental factors and quickly update actual object grid knowledge to perceive this same real object. The currently estimated line of sight's beginner to advance on the able to fully experience grid could now be applied to everything else in the scene. The imaginary object's line of sight mimics the movement of both the spatially documented grid. [6]. When the software transfers the simulation environment to the continuous manufacturing scenario, as shown in Figure 7, users can really as well as intuitively experience the device's incorporation effectiveness.

- *Human Machine Environment Interaction-Based Drag-Teaching:*

The two most popular industrial automation operational approaches are navigation system of the light sensor and program development. This system does have a sophisticated drag-teaching function that makes it easy for customers to evaluate the effect of movement of the robot in the environment.

"AirTap" and "Tap&Hold" [7] After researching the system's demands for gesture engagement in different contexts, they became selected as the main gesture interaction methods. Clicking motions can also be used to do a range of system functions, include checking metadata in the components surveillance environment and animation the construction route with in automated assembly component. The dragging motions are used to perform modification and navigation activities in the production and assembly mode. When the person is looking at the end of the bionic manipulator, he may confirm the beginning of drag training by making the motion illustrated in Figure 8 and afterwards pushing the machine to move.

Figure 8: Drag teaching.

- *Inverse Kinematics Solutions and Modeling::*

Unity3D is among the most capable virtual reality production engines nowadays. It contains a number of Web applications required for HoloLens development. Computing in the C# language is used to control it. The integration can enable the creation of model observing, virtual assembly execution, and three - dimensional guidelines recommended in the simulated assembly system. But in the other hand, its capability to build models is limited. As a reason, the model should be built using sophisticated 3D modelling software preparatory to the

building of the network. The model is next converted and put into the Unity game engine software platform. Figure 9 shows the steps interested in creating a model and then transforming it to a new layout.

After you've exported the designs, you'll need to add a computer numerical control script towards the robot model's mother level, and then populate in the script's attributes with the data needed. Change the data of the parameter settings after that. The parameter of "Use Rotating Limits" should therefore be set to "true." Add a skeletal node to "Bones." Match the "Weight" of a particular bone node to the robot knee numbers. A good description is the Motoman HD20. The solutions connection is searched less when the amount is tiny. If Bones are finally established, a blue line might well be observed crossing through these important nodes throughout the robot [8].

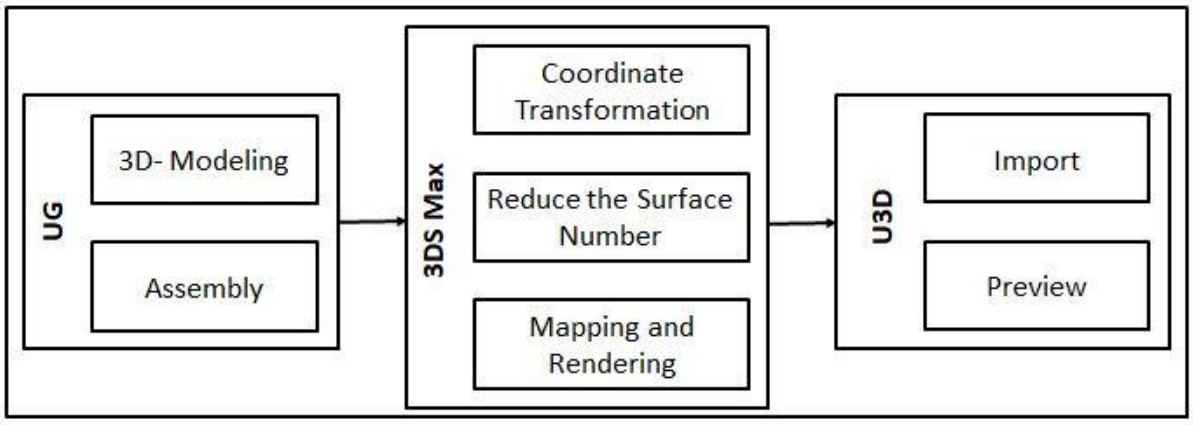

Figure 9: Model Establishment and Format Conversion Process

A blue line can be seen running across these important nodes in the robot if Bones are successfully constructed, a blue line can be seen running through the robot's critical nodes as shown in Figure 10. Then, based on the current setting of the robot connection rotation limitation angle, add an angular velocity limiter, a rotating limit hinge components, and set usage limits to correct or incorrect for each node increased the limit and minimum movement angles after that.

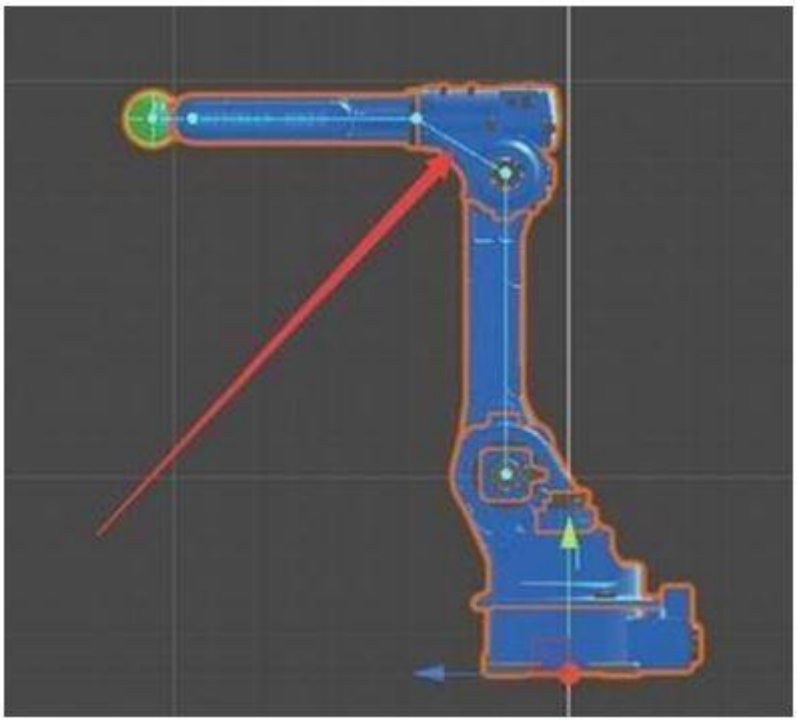

Figure 10: The Developed System Interconnect as seen on a computer monitor.

The CCDIK Target has the same target as the CCDIK Target. Parts are the most important aspect of rotation tracking. The "Size" range has the same amount of key points. In other words, there is no proper nonlinear model

predictive algorithm for unrestricted angle rotation components. As a result, whenever dealing with uncontrolled angle rotation connections, including such robotic chassis, a Turret assembly must be modified autonomously. Setting the undercarriage as an IK constituent is incorrect. As a result, your six-degree-of-freedom vehicle has only set results must be produced in reverse mechanics, and the shoulders key node has been used as a Turret portion.

At the same moment, it's interesting to note that the programming units component is being used by the robot management component to execute network broadcasts. As a conclusion, make sure the correct elements would be in the same gaming world, but that the Animation, CCDIK, and turrent sections are all included.

2. LITERATURE REVIEW

The emergence of Virtual-Reality, Amplified, and Mixed-Reality innovations, according to research Flavin Carlos et al. [20], is moulding a new environment where virtual and physical items are integrated at various levels. The customer interaction panorama is developing into sources of variation of hybrid experiences as a result of the growth of portable and embodied technology, as well as highly engaging, physical-virtual linkages. Nevertheless, academics and practitioners have failed to adequately define the parameters between these new realities, techniques, and interactions. The focus of this research is to provide a greater understanding of these notions by merging technological (embodiment), psychological (presence), and behavioural (interactivity) perspectives to propose the "EPI Cube," a new technology taxonomy. The cube permits academics and administrators to describe all present and prospective innovations that might enhance or strengthen customer interactions while also simultaneously creating along the customer experience. The study finishes with a consideration of academic and managerial consequences, as well as a research report for the prospective.

B. J. Park et al. highlight that augmented and combined reality is a constantly developing set of interaction and presentation technologies. These techniques may combine virtual items with the surrounding world in two or three dimensions. The foundation of interventional procedures is image guidance. Tomography can be more widely obtainable or exhibited in actual three dimensional space during treatments with augment or mixed reality, increasing guidance at periods when it is most needed. The current circumstances of this technology are discussed in this review, which is following by a basic description of their internal dynamics and issues with 3-dimensional representation. Finally, prospective and existing future diagnostic and interventional uses are reviewed.

X. Zhao et al. expresses his view on it, stating that gadgets are perhaps the most conspicuous manifestation of multidimensional immersive experience. There are discrepancies in design process, measuring, and technological comparisons. To compare and consider different features and functionality for each technical specification as well as representations. Smart Audio is predicated on the challenging actuality of media convergence's inaugural worker. He carries the most commonly used version of windows on interactive media on his head since he has studied for as lengthy as he has in this Industry. It is compatible with all types of applications. It does not add any extra equipment as long as even the device has been used as a display, simply the subtle and s ophisticated manner, and seems to have a powerful adequate PC. It is quite identical to a Personal Computer (P C) attached to a separate device and therefore does not require entertainment integration. Van is a lot similar and does not need media synchronization or the use of a different standalone equipment linked to the PC. It now wo rks on its linux kernel, which limitations the types of the little apps it can run.Virtual world, commonly referred a s nuanced view, is an application that allows users to combine digital content with the actual environment while preserving visual contact with each other. As a consequence, digital learning has evolved to the point where the program is known as Fusion Application media. Fusion Television will provide support via a video link and to promote dialogue as well as learning from experience, SMS appropriate statistical resources are available.

3. DISCUSSION

The ARToolKit was being used to create the MR elements proposed in this research, and it is challenging for common users to develop their own. Despite the reality that this is a subscriber tool, it does require specific knowledge, such as Dreamweaver Director and also its scripting languages. Traditional C++ development, which takes time and effort and expertise, will be redundant thanks to the application program. As a result, the average consumer will be ready to return to content production rather than engineering. Currently, a composition tool is being utilized to develop MR material like improved reading materials and the medieval dungeon system, which were addressed in this work. This tool can also be used to build MR contents using a the double identifier.

To produce stuff, you'll need to develop a 3D object or 3D animation seperately using 3D modelling tools. This publishing tool's major function is to make this device conform to the designated marker. The numbers of markers, their location, including size may all be changed, as well as the positioning of a three - dimensional object and

zooming. It also enables the capacity to add annotation, audio, and bookmarks. The writing moment in which the amygdala of the human brain was attributed to the marker and then a name annotations was added. The situation in which this information is executed and indeed the description and description are seen on the indicator.

This research has looked at how MR may well be utilised to integrate 3DCG innovation to teaching. The idea of combining animated 3DCG with the physical realm is MR's special property. By utilizing existing the special feature, it is conceivable to connect it with conventional teaching media inside the actual world. As a conclusion, the integrated classroom management, which leverages mixed reality technology to improve the standard teaching atmosphere, was proposed in this work. The three following implementations were studied the results showed:

- A medieval dungeon system,
- Supplemented textbooks,
- A medieval dungeon system,

Using an integrated environment for learning, however, everything seemingly impossible proved attainable.

- To evaluate the additional details available by 3DCG with a physical device, turn 3DCG invisible.
- Annotation offers a description to something like an actual item.
- distinguish Different textures have been used, and different data are compared.
- A real-world object should serve as an intuitive design.

Moreover, in terms of making integrated learning increasingly practicable, a subscriber writing tool has been developed to let regular users focus on developing material quickly. As a corollary, the publishing tool that has now been development was provided. Even though MR technology does indeed have a long road ahead to go and is afflicted by technical difficulties, the possibility for transforming traditional education systems is unlimited.

4. CONCLUSION

Personal innovativeness and facilitating conditions of use had a moderately strong significant connection. It becomes reasonable to suppose that if individuals frequently cope with different communications technology, they will become even more adept at comprehending the design and performance of new systems, along with the MRRC, when they've never used it before. The willingness to utilise the MR system seemed modestly determined by the perceived comfort of use. These researchers therefore conclude that since it was their first encounter engaging with an MR system that needed individuals to control indicators and a camera, they encountered problem getting used to the equipment. The willingness to practice had a slight favourable connection with happiness. The fact that the MRRC platform was designed basically and may be deficient in enjoyable characteristics may have impacted their adoption decision it in the future. Overall, access control intending to use MR technologies was determined by evaluations of profitability, which were strongly affected by judgements of ease of use, and basic challenges, which were deeply influenced by that of the MRRC's feelings of joy. Furthermore, regression analysis indicated that cognitive utility is the most essential component impacting users' desire to embrace MR future technology. As a result, the participants were just not swayed by the accessibility of use or fun components of modern innovation or educational tools, instead and emphasised the program's utility as the major reason for using it in the coming to aid their education. It is important for MR development teams to collaborate closely alongside experienced professionals to create a product that is effective for education and learning in needed to guarantee that educational applications incorporating MR innovation are widely understood. MR technology might well be utilized to produce real-life classroom environments, providing it more interesting for learners or perhaps motivating children to study. There are also some flaws in this work. The study might be performed in the future with greater individuals as well as a more representative gender or ethnicity. Second, simply descriptive statistical analysis, basic connection, and simple linear regression techniques were had to get the results. To even further understand the true nature of the correlations here between constructs, additional complex regression analyses might have been used.

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