

**IMMERSION TECHNOLOGY – VIRTUAL FACTORY**

**NAME**

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## **Abstract**

**Immersion** is the state of consciousness in which a person's awareness of his physical personality is said to be diminished because of the surroundings, frequently artificial. This mental state is often accompanied with spatial excess, intense focus, a distorted sense of time, and effortless action. The term is widely used for explaining the immersive virtual reality, installation art and video games. Many companies have now started following the virtual immersion to simulate the process and manufacturing of the industries. Immersion is now even used to create a virtual environment and give training to the people in the virtual environment and then move them to the real production environment. This paper presents a structure and architecture of a method of simulation to meet the requirements of Virtual Factory Engineering (VFE). Combining Virtual Reality, CAD and discrete event simulation techniques, the simulation methods provides static and dynamic movement functions for implementation of VFE throughout the lifecycle. The static simulation can be used to evaluate the factory texture. The dynamic simulation enables us to evaluate ergonomics of factory, feasibility of production plan, process performance, operation of factory, and to train operators safely, which cover the whole Virtual Factory Lifecycle. The principles of the key techniques of VFE, including virtual factory data management system, static and dynamic simulation, are also to be analyzed. The Aim of the system is to develop a 3D space using a program, and then person operating the program is made go into the developed 3D space. This is done by making a stimulus in his brain and several nervous reactions makes him dive into the 3D space created. The 3D goggle was used for the generation a land texture for the person. This 3D space is assisted by a small numeric computer program and this program helps in determining the feel of the environment via the signal and searches conducted in the environment.

## **Introduction**

### **Virtual Factory:**

Virtual Factory is said to be a formulated computer simulations for a distributed, integrated, system-based composite model of a total manufacturing and production environment, incorporating all the tasks and resources necessary to accomplish the operation of designing, producing, and delivering a product.

To survive the worldwide competition in the production industry, many companies have introduced digital technology. Digital technology not only shortens the product development cycle times but also improves the precision of engineering simulation and also reduces the errors committed. However, building the virtual objects needed for a digital production environment requires skilled human labors; it is also costly and time-consuming. A high end precision environment with such a high level resources is also needed for a higher end precision simulation. The method integrates real-time objects, such as live images, with the virtual objects of a virtual production system. This integration type minimizes the cost of implementing virtual things and enhances the user's sense of real sensation. We studied several methods and derived a general framework for the system. Finally, we finalized our idea into a virtual factory layout system. A framework was developed to encapsulate simulation of the data from real-time data and process data for visualization based on reality. The Virtual instrumentation tools and software are further used for the calculation and simulation.

### **Immersion:**

The Total Immersion in virtual reality can be defined as a space of virtual surrounding where everything within the space of proposed reality. The Total Immersion in virtual reality can be

defined as a space of virtual surrounding where everything within the space of proposed reality. This makes the immersant to forget the real world and get connected to the virtual space all together.

### **Types of immersion Technology:**

According to *Ernest Adams*, author and consulter on game design, immersion can be separated into six categories:

#### **Tactical Immersion**

Tactical immersion is experienced when performing tactile operations that involve skill. Tactical immersion is produced by challenges simple enough to allow the observer to react to it in a fraction of a second. To create tactical immersion, you must offer the observers a flawless user interface, one that responds rapidly, intuitively, and above all reliably. Tactical immersion is usually destroyed by abrupt changes in the nature of movement.

#### **Strategic Immersion**

Strategic immersion is much more related to cerebral, and is associated with brain challenge. It's about seeking a optimize solution from the number of available solutions. The chess players will often get into this strategic immersion when choosing a correct solution from among the world of possible solutions. To make the observer continue in the strategic immersion, the texture play should be good and contain nice mental challenges.

#### **Narrative Immersion**

Narrative immersion comes when the observer was involved deep in a thought. It is something similar to reading a book or watching a play. The observer can adjust to the bad strategy and game play. When, he is involved in Narrative Immersion.

### **Spatial Immersion**

Spatial immersion occurs when an observer got the feel that the simulated world is perfectly real and true. To say he should forgot the real world. The Observer will get a feel that he has gone to that place really.

### **Psychological Immersion**

Psychological immersion occurs when an observer confuses the simulation with real life situations.

### **Sensory Immersion**

The Experience got when the observer entered the three dimensional space and being completely ruled by it. The Observer experiences a sync of both the virtual and real things.

## **Requirements of Immersion Technology:**

### **Understanding of the Nervous System:**

There is a high level of understanding required to simulate the Central nervous System, it should respond to the motor impulse and muscle contraction even. This makes the correct action from the user and the same will be replicated in the virtual environment.

### **Ability to manipulate CNS:**

The nervous system should be manipulated, so that all the movements and thinking of the observer should get reflected to the virtual environment. This is achieved by non-invasive devices using radiation. In near future the invasive cybernetic implants are likely to reach the market. They are expected to be more and more accurate. This kind of Manipulation could occur in the nervous system at any part of it- the cerebral is likely to be toughest; as all nerves originate from here and pass through the spinal cord. This could be the only site of manipulation. Molecular Nanotechnology is likely to increase the precision obtained.

## **Computer Hardware/Software To Process Inputs/Outputs:**

A very powerful and high performance Artificial Intelligence would be required to process all the inputs from the CNS and then run the test and create the simulation accordingly and also it should do the reverse things of getting the input from the virtual environment and make the user react to the adverse conditions in the virtual environment. Strong artificial intelligence is required to write a program to manipulate the real time things and send an impulse to the system.

## **Components of Immersion Technology:**

A fully immersive, perceptually-real environment will consist of multiple components. The following hardware technologies are developed to stimulate one or more of the senses to create perceptually-real sensations

- **Vision**
- **Auditory**
- **Tactile**
- **Olfaction**

### **Vision:**

The vision elements have number of sub elements.

#### **3D Display:**

A 3D display is a device having the capability to give the 3D image to the viewer of the image. This 3D display is further divided into different types Stereoscopic, Auto-stereoscopic, Computer-generated holography, Volumetric displays.



### **Holography:**

Holography is a technique, where the light is scattered from an object and it was recorded in films. This image is later reconstructed to represent the original images in 3D. The image will get changed depending on the position and orientation of the viewing system. This makes the recorded image appear to be a 3D image.

### **HMD:**

A head-mounted display **or** helmet mounted display, both abbreviated 'HMD', is a device worn in like a helmet and it contains a small eye piece in the front. The eyepiece will sometimes present in only one eye and sometime in both the eyes.

A HMD is something like goggles having one or two small display connected in front of the eye and a semi transparent mirror attached to the side. The display units were of various types like CRT, LCD, OLED etc. Some vendors use the mixture of these displays to obtain a perfect clarity and feel.



### **Full Dome:**

**Full dome** refers to immersive dome-based projection of the environments which is most time rendered in video format. The dome is fitted horizontal or in the same way as the real time environment, this is sometime contain computer animations, live images and composed textures.

## **Auditory:**

**3D audio effects** are added to increase the voice clarity and give the real feel of the environment including the sound of the machines and even a small breeze will be replicated and heard accurately. These are used to create illusion of sound sources played in 3D spaces

There are several types of **3D audio effects**:

- Some only widen the stereo by modifying phase of the audio.
- Some will magnify and place the sound outside the stereo range
- Some will include the original 3D simulation.

## **Tactile:**

**Haptic technology** or **haptics** is a tactile feedback technology that used the touch sense of the user. The pressure applied by the user to touch the surface is calculated by the tactile sensors and are used to replicate the same feel in the virtual environment. This kind of mechanical simulations can be used to create the objects in the virtual world. The computer will then react according to the touch given by the observer. The tactic devices are capable of observing the reactions in bulk, but they are used in specific for each of the reactions in order to replicate them more precisely.





The invention of the haptic technology has given the possibility to study the human touch sense. This technology is widely used in touch screen mobile phones under small scale usage. These sensors are highly used to read the humans and without these it will turn out to be very difficult. The new research tools are now working as how to understand the touch and the brain related function behind the touch function.

### **Olfaction:**

**Machine olfaction** is something like an E-Nose. It renders automatic simulation of smell. These elements generally got much of AI to read the human impulse on sensing a particular smell. This impulse is recorded by these devices and was used the reverse feedback to virtualise the same. When an impulse of that kind is detected by the system, it will react according to the smell associated with it. The entire system works on converting the bulk sensor signal and produce the associated digital signal which will be read by processor and give out the result after the data processing.

### **Interaction:**

These technologies provide the ability to interact and communicate with the virtual environment.

- Gesture Recognition
- Brain–Computer interface
- Speech Recognition
- Omni Directional Treadmill

### **Gesture Recognition:**

**Gesture recognition** is a topic in computer science and language technology which is involved in developing computer algorithms for the human gestures. The gestures can be a part

of any body movement; the system should be capable of capturing all the Gestures and generate the electronic impulse accordingly. Now researchers are working to read the emotional gestures of the face and the hand movements.

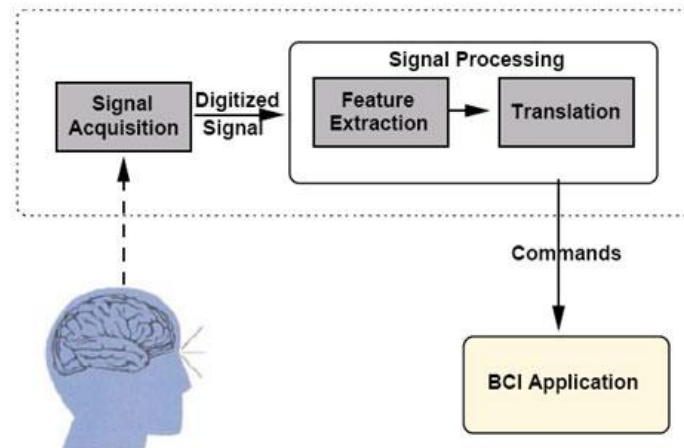
Many techniques to use the camera and computer vision to intercept the vision language were made in recent times. This gesture recognition is a way for the computer to understand the human body language and helps building a bridge between the human and machine interaction. This gives the opportunity to reduce the input given by the keyboard and mouse



The Gesture recognition makes the possibility for the humans to interact with the machines directly with need of may mechanical devices. Using this system, you can just point your finger to the screen and reading your finger the mouse pointer will move accordingly.

## Brain–Computer Interface

A **brain–computer interface (BCI)**, is a device that enables the direct communication between the brain and an external device. This is referred as **direct neural interface** or a **brain–machine interface**. BCI is targeted for assisting, augmenting or repairing human cognitive or sensory functions and other replanted impulses. These applications are widely used in the restoring of vision and hearing from the impulse received from the brain.

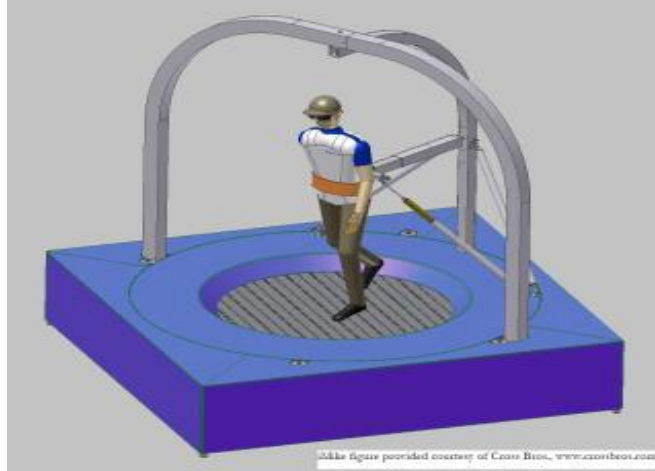


## Speech Recognition

**Speech recognition** is used for converting the spoken words to text. The system will work on to understand the language and the ascent of the speech and will try to convert it into text. This will have a lot of time involved in writing codes, if the system just understands our commands perfectly, then we can just give voice command to the system instead of the programs. The various features included in the speech recognition are voice dialing, appliance control, data entry, document preparation and speech to text conversion and processing the converted speech.

## Omni-directional Treadmill:

An **Omni-directional treadmill**, or ODT, is a device that allows a person to do any kind of locomotive motion in all directions. Omni-directional treadmills are employed in immersion and illusions to allow the users to walk through the environment by making the locomotive motion in the treadmill.



Advantages to pairing an ODT with an immersive virtual environment include:

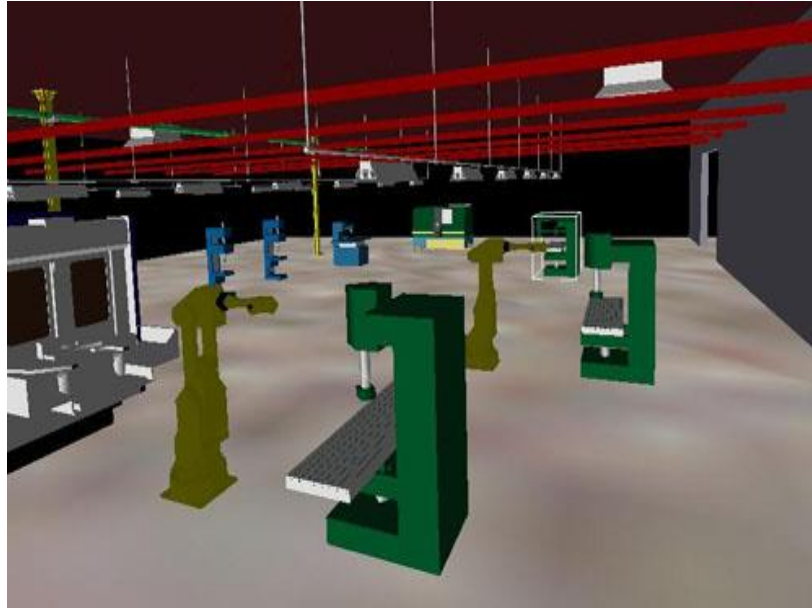
- Natural navigational movement of the system user within the enclosure will be simulated as a physical traverse in the virtual terrain.
- This will give a whole body experience starting from the head to leg. The user will feel the movement in all the parts. The users will even feel the tiredness of over walking.
- Reading the hand and legs motion and change the direction of passage accordingly, this has highly reduced the usage of sensotronic elements used for this purpose.

## **Our Development Methodology:**

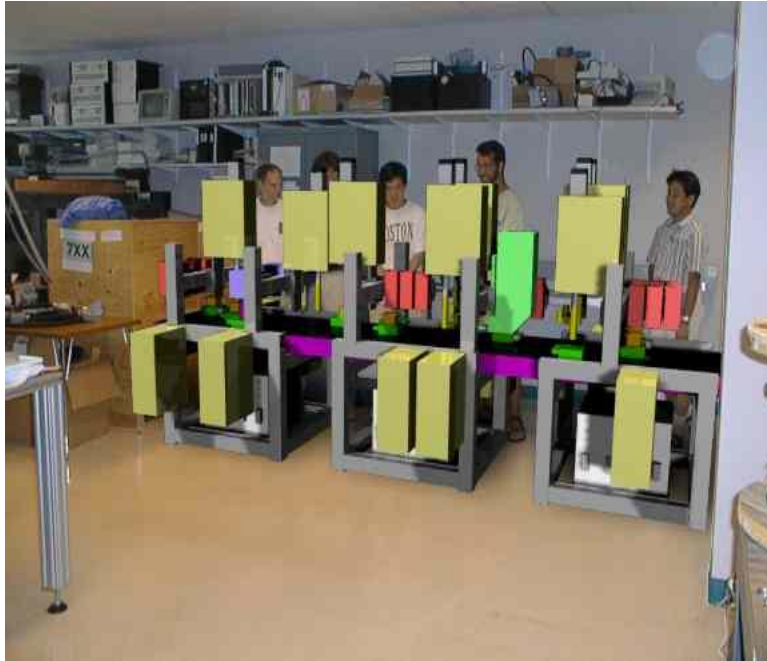
Our system comprises almost all of these components. The main aim of the system is to develop a 3D space using a program, and then person operating the program is made go into the developed 3D space. This is done by making a stimulus in his brain and several nervous reactions makes him dive into the 3D space created. The 3D goggle was used for this sole purpose of generation a texture for the person.

This 3D space is assisted by a small numeric computer program and this program helps in determining the feel of the environment via the signal and searches conducted in the environment. This signal was reproduced to give the same feel to the observer of the program.

Thus the observer feels a real time movements and he was able to interact with the space created. The space will also react according to the observer.



These to and forth interaction is used for communication between the virtual objects and the observer. The greatest advantage is that, we can modify the behavior of the virtual objects at any point in time and make them work according to our need. The observer will get the changes now and then and he will have to react accordingly. This is highly used in developing obstacles in video games and other Virtual techniques. This makes the observer clearly understand the environment and also will get used to all the different things that can happen in the environment. Thus a full manufacturing process can even be virtualized and given for the observer for the training, where he can play with the machines in whatever way he likes, this model of study and usage of machines is used highly in research and in disaster testing. Thus a virtual factory can be created for any industry and all the process and happening in the factory can be simulated in the way we want.



This turns out to be a best solution in handling the trainees of manufacturing process and also can do any kind of testing without the actual fear of loss of money or life. The future world is heading towards the art of making everything in virtual, might be the whole universe will be made virtual and you can be the king of it and rule your region. Our process to create this virtual factory is also a seed in this process. This is be followed by many advancement in future.

## References

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2. Virtual Reality : [http://en.wikipedia.org/wiki/Immersive\\_technology](http://en.wikipedia.org/wiki/Immersive_technology)