Modern Simulation and Modeling Techniques Used For Virtual Object Animations

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Abstract – In the computer science world much vast advancement have been made. One such advancement is the invention of simulation and modelling technology. Simulation and modelling is one of the emerging fields of science, which has great system tradeoffs. It has wide range of applications in real world jobs due to its highly accelerated potentials. The purpose of simulation and modelling is to fabricate technology that entails representation of certain key features of a selected physical and abstract system. This technology has been most commonly used in games. The basic purpose of using this technology is to represent some real things, human's real looks and some of our real life activities in the form of games to predict actual behaviour. In this paper we have given an overview of the latest techniques for computations and up gradations in different contexts of simulation and modelling. Finally we consider the descriptions of its validity and experimenting with them can save time, sufferings and money.

Keywords - Simulation and modelling, Methodology, simulation models, Simulators, military simulation.

I. INTRODUCTION

Simulation and modeling originated in 1960's. The author Sperry Gyroscope started simulation at his site at Bracknell Berkshire England in 1964. The first and main activity of simulation was military simulation that made use of valve analogue simulators. Then in coming few year a coffee machine was demonstrated to replace tea lady. That machine poured hot water, coffee powder and sugar into empty cup. Much advancement were made, which resulted in digital system from analogue system and then every machine was digitalized. From 1970's onwards many machines were invented that made use of both analogue and digital systems. Although the digital machines that used simulation were bit slowly until the intricacies of numerical integration and stiff systems were understood, .i.e. incursion into hybrid computing was done. Below is a brief introduction regarding simulation and modeling.

A. Simulation:

Simulation is a branch of computer science that entails the representation of general features of physical system. It is defined as the initiation of real world processes or state of affairs that operates in time and space by compressing it. It is a vast field having many branches and is used in different contexts e.g. simulation of technology, safety engineering, training, education, video games, flight simulation, scientific modeling and games etc. When real systems are inaccessible or to

make alternatives for real world things by implementing real world effects, simulation is used. Many conditions give birth to simulation as follows:

[a] A real world idea is designed but has not been given a physical existence.

[b] Physical systems have many side effects or o pros and cons but their dangerous side over takes their advantages, so simulations are done to lessen their side effects and work in a safe environment.

[c] Simulation is also done, because if it is compulsory for the manufacturing and verification of system and design and operational predictions and scheduling. Not only this provision for training staff in economically and save operational procedures.

B. Modeling:

It generally refers to developing the understanding of the system through models at some point in time and given space. It is a field which helps different parts of physical system to interact with each other. Level of understanding achieved by this system is rarely achieved by another discipline. Models help the understanding of systems by making them more generalized and simplified. A model demands relevant and according details. If the detail expressed in model is too little then there are low chances of understanding, but if the detail expressed is too much detailed then chances of complexity may increase. So models have to be according to the relevant information demanded.

First a model of a real world system is made that's modulation and the computerized version of that model is

simulation, giving that model a real appearance. Simulations are generally iterative in nature. .i.e. developing a model, simulating it and revise the model, and then continues until a well developed understanding level is achieved. Modeling and simulation is much of an art form [1]. One can learn to ride a bicycle by keeping himself engaged with the bicycle. It can be learnt through reading and talking with others and extracting more ideas from others. But one should have skills in model designing.

There are many applications which are needed to support services for various simulations for building scenarios. Sometimes it is not always true that those applications are always able to meet the needs of your proposed algorithm. Or sometimes the tools which you have used to depict real behavior may create problem. To overcome these kinds of problems co-ordination among different infra-structures should be maintained.

C. Modeling and Methodology:

As there are vast developments made in science, so is the case with simulation and modeling technique. The simulation technology has also experienced some great changes from partial to full cycle simulation and from performance to hybrid simulation combining all the performances and infra structures. Nowadays simulation science and technology theory is used as guidance for the various activities of simulation. Before starting the process of simulation and modeling, concept of modeling and methodology should be kept in mind. [2] Methods can be techniques or tools and methodology is a theory used to describe the methods and how the particular method will be carried out. To carry out simulation and modeling technique not only a single method is used but a group of different methods is preferred. The basic purpose of using methodologies for guiding various simulation activities is to achieve the correct simulation target by using correct method and appropriate simulation procedure.

Before designing the model for simulation one must first write or develop a raw abstract just to highlight the main features [3]. In raw abstract the false and rough information should be eliminated and it should just contain the true and precise information relevant to what is actually required. Raw abstract should be written using natural language through perceptual cognition using various methods.

After writing the raw abstract, the abstract should be checked again for validation. Once the abstract has been validated the next step is to transform it into model or you can say a computerized model, which includes formal description. From formal description we do not mean of giving a proper shape to the abstract but it means the transformation of the conceptual model into the mathematical model in which various algebraic expression, formulas, symbols and different logic rules are used.

Next part is the development of computer model. There are two major parts of a computer model for simulation [4]. One is formalization which I have mentioned above, next is the program realization. As the name indicates that program realization is coding and transforming the mathematical form into the simulation model which can be executed by the computer [5]. The thing that should be kept in mind is that before transforming the perceptual model into the simulation, it should be checked, re-checked and validated. When the model is validated it can be transformed into simulation

technique by using different means and tools that will be discussed as the paper proceeds.

At present, many features such as intelligentization and collaboratization have been added in the simulation systems. In intelligentization some features of artificial intelligence such as perceptional, imaginable and abstract thinking have been added to simulation systems [6]. In collaboratization different simulation systems can be joined with each other using network communication technology. All the simulation systems on a shared network use same resources hence producing more powerful functions and works more efficiently [7].

Selecting the correct method for the simulation is the most difficult task. Difference in properties, objects, simulation targets leads to the diversity of simulation methods [8]. However methods are not always opposite. One method can be used to constitute one or more simulation systems. It is not always compulsory to use only one method for simulation, various simulation methods can be combined. It can't be randomly selected but system properties should be kept in mind before following any method. In simulation systems the hardware and softwares of the computer, communication accessories, sensors and various simulators are tightly embedded and integrated.

D. Simulators:

The question arises that how the simulation and modeling technique is carried out? This technique is actually carried out by simulators which are machines that are used for simulating the environment which is closed to reality. Simulators are mostly used for teaching and training purpose and in some other fields for example engineering, medicine, aviation, aeronautics, psychology etc. Different simulators and their working are discussed in "application areas" section.

E. Simulation Models:

We have discussed the simulation & modeling technique in detail. Now we are going to discuss different simulation models and some of the simulation tools briefly [9]. Just like other machines and systems simulators also take some inputs and yield some outputs corresponding to their inputs. Here the inputs are some tools which when transformed produce a real environment. Simulation is carried out by using two techniques a steady-state simulation and a terminating stimulation. Both of these types take different types of input and produce a different result. In steady-state stimulation the simulation runs forever, the scenario of flow of water is the best example of this type. And in terminating stimulation there is a start and a natural end it is similar to the real life scenario in which people goes to their offices, works there and then return to their homes when their work time is over.

F. Tools for Simulation and Modeling:

Behind the simulation, tools are used to produce interactive graphics, real time models and tutorials and presentations. Today many companies make simulation tools and people get those tools and then use them for their models. List of some simulation tools is given below [10]:

[a]   RanD Model Designer:

This tool is designed by R.S ltd. It is used for producing a visual environment for complex systems. It is very user friendly and can be used for constructing complex models and to perform interactive computational experiments.

[b]   Maple Sim 4:

This tool is a product of maple soft. It is a drag and drop tool which is used for symbolically representing the simulation models. By using this tool you can make different models of one thing, and then can combine all those models producing a single model. It then runs the complete model of simulation, with a 3-D representation.

[c]   Renque:

It is developed by R. T. Consultants. It is used for constructing simulations in graphical environment. The company assures that this software builds the accurate simulation model.

[d]   MYM Visual Simulation Tool:

It is developed by T.BV. This tool solves the mathematical equations It also has a graphical interface which shows the inputs entered and how the output is computed.

[e]   Simlox:

It is developed by SYSTECON. This is basically an event driven tool which shows the change in the system's performance with the passage of time. Most of the cosmetic companies use this tool to show customers that how their looks will change as they will get older.

[f]   Sim Wiz:

It is developed by M. A. Cohen. This tool is different from other tools as it is a computer program used for running a simulation model. Program is written in a human-readable form and is easily understood by lay men. Output maybe encoded and changes in visuals are automatically done.

[g]   Arena:

This tool is developed by R. Automation. Arena is a visualized simulation environment which makes flow charts for showing how the system works.

[h]   Subscript III:

It is developed by C. P. Company. This tool is written in human readable simulation and modeling language. It is used for discreet and continuous simulations. Simscript III is an open source and people can write it in other languages also.

[i]   Sim Process:

It is developed by C. P. Company also. In this version the developers have used object oriented approach for the construction of simulation and modeling analysis tool. It makes flow charts and animation.

[j]   Berkeley Madonna:

This is developed by R. Macey and G. O. of the University of California at Berkeley. It is designed for Macintosh and windows, and is capable for solving differential equations. Most of the schools and universities use this tool for teaching purpose.

[k]   Sim App:

This tool is developed by B. Buesser and is used to develop a continuous system periodically. The whole system is created by block diagrams.

[l]   Flex-Sim:

It is developed by F. S. Products. It is used for the development and visualization of the business project. Used for determining the capacity of the plant, for balancing manufacturing lines, for testing and scheduling practices and production rates. By using flexsim the model can be viewed in 3D.

[m]   Sans GUI:

It is developed by P.Inc. This simulation environment is helpful for developers as they can develop scientific simulators without getting into the trouble of writing GUI codes. This tool is available for Microsoft platform.

[n]   Any Logic:

This tool is developed by X Technologies. It is a tool that brings system dynamics and other approaches within one language and visualization environment. The library objects of any logic allow the user to model manufacturing various business processes and human resources in natural or real manner. Any logic tool is deprived of object oriented approach. Various java applications and applets can be distributed in this tool.

[o]   Sim Creator:

This tool is developed by R Technologies. It's a graphical modeling and visualization tool. By using this tool firstly simpler models are created and after that the simpler models are joined together for creating complex models. Its version is also available for modeling 3D simulations.

[p]   Ecosim Pro:

This tool is developed by E International. It's a continuous system simulator. This tool is used for dealing with various and complex algebraic equations. It has got very amazing graphical user interface. The icon which appears in the model completely corresponds to the ones in your system. Debugger is the major feature in it.

II.   APPLICATION AREAS

We have already discussed simulation, modeling and different tools of simulation, we will now spotlight on some of the areas where this technique is excessively being used.

A. Virus Simulators:

These simulators relate to the computer virus. These virus simulators have usually three perspectives.

[a] First perspective is they demonstrate audible and visual effects of computer viruses.

[b] The second perspective is creating a computational environment by simulating files and disks and then simulating viruses that are run over the simulated computing environment to experience the effects of viruses over real computers. Through this every step of process can be observed without the danger of 'real infections' over real computing environment.

[c] Third perspective is generation of scanning strings to detect and scan real viruses.

B.   *In Entertainment Field:*

Combat flight simulators are used. They are simulated video games; they are more or less similar to the flight simulator. They do not have simulated physical recreations of the actual aircrafts cockpits. A break through occurred when different play stations were released which would go on as the Ace Combat series. It made use of simulated helicopters combat and later Jane's WWTI fighters but lacked more visible damage. Classification of combat simulators is done according to their historical period, type of craft and their dependency and preciseness level..e.g. in world war I, Red Baron and Red Baron II by Sierra. Fighter Ace, Ace high etc. But now modern simulators of current war are classified as 'Modern Jet Simulators'. Mostly simulators were single player but from late 1990's some include multiplayer network capability.

C.   *In Aviation Field:*

In aviation field flight simulators are used. It is an electronic machine giving the user an environment of real flight piloting. It provides auditory, visual and kinesthesia stimuli.

Figure- 1: Real Flight Simulator

They facilitate by providing simulated environment for communication systems, warning systems, test its compatibility with other embedded systems. Different flight simulators have different level of realism, such as calculating

cross winds and testing landings, updating of cockpits with up to date electronics.

Figure- 2: Galileo Simulator

D.   *In Aeronautics Field:*

In this field Galileo simulators are used which is basically Galileo positioning system satellite navigation which is yet underdevelopment by European union(EU) as another channel to US global positioning system(GPS) and Russian GLONASS system. An RF signal is generated by the Galileo constellation simulator that would be seen at Galileo receiver under test. All the environmental effects such as Doppler effects, reflections and atmospheric refractions are all accurately modeled.

E.   *In Field of Training:*

Driving simulators have vigorous and long lasting effect as a training device in basic learning of driving.

These types of simulators are mostly used in Netherlands. Driving classes are bit expensive, so driving simulators are used due to attractive savings of money. Simulators having static base are used in research.

Figure- 3: Driving Simulator

Driving simulators differ due to essential components such as mock up, vehicle mode, traffic model, display scenarios etc. They have many advantages:

[a] Their profitability is increasing.

[b] Faster commentary of broad variety of traffic situations.
[c] Feedbacks are different perspective.
[d] Demonstration of stratagem.
[e] Safety environment practice.

F. In Field of Artificial Intelligence:

Thyrix is a catalyst environment simulator. It is basically contrived for artificial intelligence and also for artificial existence research. It is made very efficient for speed and is thus very beneficial for unfolded experiments. It also benefits SDK (software development kit) for many creation applications such as games. It works by simulating different segments like arms or bodies that interface in 2D environment by making use of Aristotle physics. Its functionality includes inauguration of fast algorithms for solving limitations that are produced from segmentations.

G. In Field of Sports:

Golf simulators are used on a golf course. They simulate golf playing by creating an environment of golf course. In this the player experiences the real shots as if he is playing golf in reality. The player only swings his arm and envisions a golf shot. The basic purpose of golf simulation is to see and understand the trajectory of the shot and also helps the player to understand the reason why the shot went to that trajectory.

Figure- 4: Golf Simulator

Its major benefit is keeping golf game fresh and bracing and brittle. In winter when golf courses are mostly closed, golf simulators have great benefit. It also has a disadvantage that full shot is not trajected.

H. In Marketing Field:

Stock market simulators provide benefit society for understanding of investment of money works. This is very beneficial to those who have a fear of numbers and investments. And to those whose concepts of numbers are intimating. Here stock market simulator come in handy and provide both fun and interesting experiences. Online simulators are easy to learn and use that simulate real life working of stock. They imitate real life circumstances that help the users to experience and handle the market stock

exchange. The best stock simulators charge broker fee and commissions. Which help the user handle cost factor, when purchasing market decisions. In classes it is also being used to teach students about market dealings by making use of stock simulators. Students enjoy learning stock market through simulators.

I. In Field Of Physics:

Monte Carlo simulators are alternative for simulating physics and mathematical systems. Systems which have large number of coupled degree of freedom, such as fluids, disordered materials, and cellular models etc. It is better used in understanding the actual characteristics, features, observations and cost overrun and schedule management. It predicts those features and reduces risks rather than human intuitions or methods. Monte Carlo is not a single method, but comprises of many approaches. These all approaches make use of common pattern i.e. take an input, determine the computation and aggregate each computation and commutates final result. This method can be referred as a game of battleship. Players make random shots. The player implies algorithms, and then the basis of the outcome players estimates the locations of other player's ship. These methods are also used in design and visuals of video games and films etc. finance and business, telecommunications and artificial intelligence theories.

J. In Field Of Medicine:

Major advancement made in field of medicine is cardiovascular simulator. This simulator keeps track of human respiratory and pulmonary system. They are mainly used to maintain the heart rate and blood pressure. In this a robot is used for experimentation. Conditions are simulated in order to maintain the blood pressure and heart rate of the subject. It benefits the doctors as they can well train themselves in field of cardiology. By handling different conditions in heart handling, doctors learn more causes of treating with them.

Figure- 5: Cardiovascular simulator

K. Military Simulation:

In military simulation, environment of war is intimated. This model truly depicts the real environment of war. Most

people take it as a game but in real its not a game at all it's a training for war. In military simulation the environment is derived from historical world wars. In this simulation the officers teaches their juniors different techniques which needs to be used during the war .i.e. they teaches them where to stand, how to act, how to move, how and when to attack enemy etc in short the full scale field exercises. These all scenarios are taught by creating real time simulation without actual hostilities.

L.   Robotics Simulators:

This simulator intimates the real robot. One can say that robotics simulator is the initial model of the robot in which all the applications are embedded in the simulator that can be transferred into the real robot any time. Robotics simulator involves behavior based simulators which shows different actions that may take place in different scenarios.

Physics engine simulator is used inside this simulator which shows the real behavior of the robot. Scientist has created this simulator so that they can test the applications which they want to embed in their real robot. During the working of the simulator if the developers find any defect than they immediately change it and run it again before embedding that specific application inside the real robot.

III.   EXISTING SYSTEMS

A.   3D Simulation For Training Mining Operators:

As we know that simulation technique is commonly used for training purpose, so in the case of mining operators some simulation is needed to be developed for training the operators which provide the operators a complete real environment [12]. Different companies such as SIMLOG are working towards development of such simulations for mining operators because they must also not to be ignored. The basic task of the operator is to keep an eye and work with the heavy machines, and for this he first needs to work on simulation environment for better understanding.

In the mine the operator has to work with huge automation machines which are more powerful and complex [13]. The operator has to work with these machines for surface mining, drilling, breaking the rocks etc. So proves to be a complex task. Hence the operator needs to work with these machines with full skills and with full command on the machine. So, a simulation is required to polish the skills of the operators such as working with huge machines, placing the machines on their right position, and hitting the target area for drilling correctly. This is the place where a simulation environment is required.

A new term, virtual reality has been introduced which describes the interaction of human with 3D models. In a 3D model the environment responds to the user's input. It is not known before that how simulation works because data flows differently for every input provided by the user. Rather just teaching the students on blackboards this method of teaching by using simulation model should be preferred.

Training the mine operators using mining simulations is similar to training of pilots using flight simulators. A simulation was developed by Spanish companies in which simulation produces the environment similar to an elevator that brings the people down into the mine along with their

equipments. The purpose of this simulation was to make the operators aware of different happenings in the mine.

The simulation environment has been developed by a company Simlog for operators to handle different equipments and situations. This simulation produces an environment in which the operator has to perform some task like placing the machine and drilling the target.

[a]   Design:

Figure- 6: Drill Jumbo Operator

The simulation that has to depict the behavior of some real machine happens to be much more complex. According to different cost effective approaches, it is highly recommended that working in simulation environment and training people on them is the best cost effective technique rather training them on real machines.

The steps that must be followed while creating any simulation are:

[a] The computer that has to drive 3D simulation requires greater horse power to show the real behavior of different elements.

[b]They must have good visual display.

[c] Audio must be provided along with the visual display to show the real behavior and sound of machines at work.

[d] Effective simulation is the one that shows natural behavior; in this case the simulation must show the natural behavior and working of the machines.

The three factors visual display, audio and natural behavior should co-ordinate for appropriate simulation.

While creating the simulation one should not forget to embed all the possible steps that need to be performed, if the simulation lacks any step then it is considered the biggest weakness of any simulation model. As focusing on each and every step maybe helpful in cognition process.

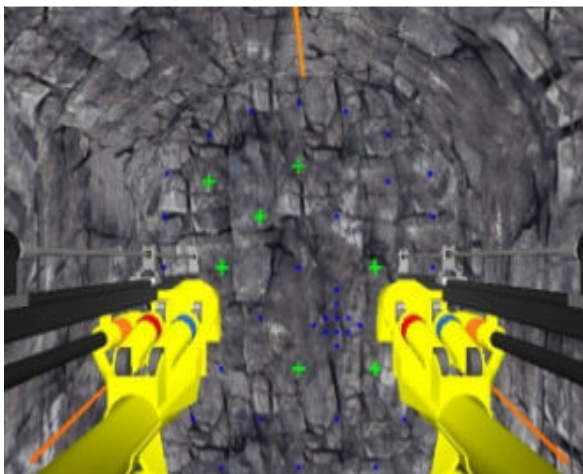### [b]   Drilling Jumbo Operator Training Simulator:

Figure- 7: Drill Jumbo Simulator Created By Simlog

This training simulator has been developed by Simlog. This simulator has all the parts of real drill jumbo (driller used in mines) including levers, buttons and joy sticks and also involves a compatible computer. It has a 3D graphics which combines visual environment of real drill jumbo and some non real world objects. The simulator produces the real sound of drilling and digging and also of the machine at work. Next is the graphical representation, which is very strong and efficient and takes the operator step by step through every operation. As this tool shows the real working and behavior of drill jumbo so it is considered to be a very good training tool. The computer used in this simulator makes a database storing the progress of the operator and his performed simulated work.

In drill jumbo simulator different modules are working at the same time. One of the modules controls the working of the levers, buttons and the joysticks simultaneously. Whenever the trainee has to drill any surface he first has to mark the target, and then he has to drill that position by controlling levers, buttons and joy sticks in correct manner. The time in which the trainee completes the task is also measured. It is also measured that how efficiently he has drilled the surface. The supervisor can then check the trainee's performance by going into the database section.

The computer also allows the supervisor to make his own profile, and profiles of the trainees along with their daily performance. Drill jumbo operating training simulator can be used to train the operators before sending them directly into mines. But the point that should be kept in mind is that the trainee should have some of the knowledge regarding how drill jumbo works, how to work with drill jumbo etc. the simulator won't be teaching trainee the functionality of driller but it will teach him how to handle driller properly and correctly.

[c] *3D Graphics of Simlog Creator*
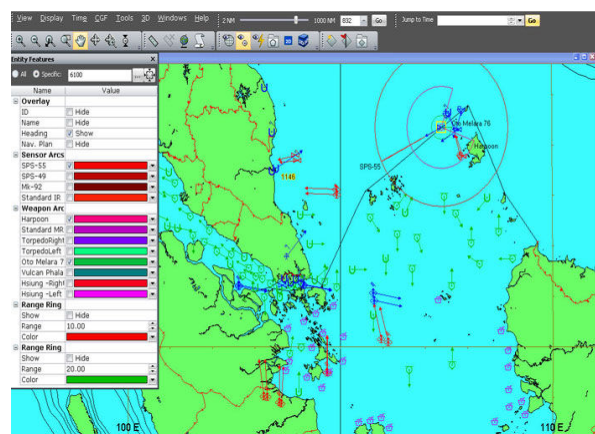

Figure- 8: Simlog Drill Jumbo Simulation

Reference: http://www.google.com.pk/imgres?

B. *Military Training Simulations:*

The system named After Action Review (AAR) [14] has been developed for military training purpose, which provides a real training environment trainees and it also evaluates their

performances during every stage. Initially when there was no concept of simulations, the officers used to go on the training along with the trainees and evaluated their performances by themselves. But sometimes they missed some of the very important aspects of the exercise and could not correct the trainees regarding their performance during the presentation of the result of the exercise performed. The AAR system gives the detailed analysis of the performance of the trainees [15].

In army's training several steps are performed, which includes development of objective of different stages, planning the exercise, implementation and last step is off evaluation of the performance. Evaluation of the exercise must be done after every stage, to inform the trainee about his performance that whether his performance is meeting the required target or not. The AAR system evaluate the performance timely, hence the trainee can correct his act at that very instant and gives him the opportunity to learn as the task proceeds. The trainees are also able to see the result of their performance. Similar to the class test, when a student gives the test he then waits for the result before moving on to the next learning process. Different computer softwares such as TAARUS have been used in this system for the real time simulation for the evaluation of the tests.

Figure- 8: War Simulation Map

Figure- 10: Map showing different regions

[a] *The approach of After Action Review System (AAR):*

The TAARUS embedded in the simulation gives away the immediate feedback during practice session. Trainees can

then evaluate themselves on the basis of those proposed results.

TAARUS produces a result which is easily understandable by supervisors and trainees. TAARUS checks the actions and the time, and then generates a map, graph and a brief documentation.

Figure- 11: War Simulation

Reference: http://www.google.com.pk/imgres?

During wars whenever any incident happened it was impossible to investigate that what was the actual reason behind it .i.e. senior officers were unfamiliar with the action performed by the junior officer. But today with the help of TAARUS software all the actions and activities performed are checked and stored and then displayed for further evaluation.

The AAR system generates huge amount of data that cannot be viewed at the same time. TAARUS includes a tool named quick80, which makes a database of the complete event and then the user can view it later on with brief description. Quick 80 provides a picture of what is happening which can then be reviewed by the senior officer.

[b]   TAARUS Map:

If the user wants to view any of the units then this map provides an interface to view the required unit. All kind of raw data is generated by the TAARUS, with the help of some tools such as commit and eland the user can extract his required data.

The pictures taken during different events are then displayed using slide show. In AAR system projector is used to show pictures instead of copying them and taking print outs.

Tactical simulation TACSIM which is one of a kind of intelligence simulation does not contain any kind of tools for the reconstruction of the events and effects of the simulation. When TAARUS was connected with TACSIM the automated flow of data enhanced the quality of the simulation without affecting the performance of the computer.
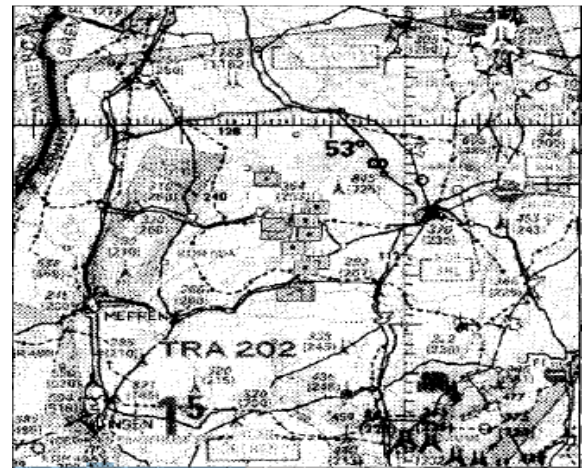

Figure- 12: TAARUS Map

Reuse of TAARUS software:
Many companies are now planning to reuse the tools and aids of TAARUS in their own product.

C.   3D Simulations in Robots:

The robot based work cells and 3D simulations have been developed but they are not used commonly because of their high costs. The high cost is due to newly developed embedded softwares and hardwares. Most of the companies do not prefer it due to cost and also because they then need some experts to operate those systems. Because of the shorter development cycles of products, there is a high demand of such products which offers high flexibility. And some new kinds of simulations are needed that intimates the real environment completely and allows the user to embed their tested programs in the real operation within no time.

The technique of creating models and designing computer programs is so complex and requires much cost and time therefore companies are not wasting their time and money in making such difficult systems. The institute of robotics research is designing systems with latest automations. It includes planning, designing programs and then creating real environment simulations by transferring programs in the system. A 3D simulation which is PC based named COSMIR (cell oriented simulation of industrial robots) are being integrated in systems for new architecture.

COSMIR is a 3D simulation model which includes modeling which is followed by the coding and simulation models. The 3D model used within VR (virtual reality environment) is used for display. The user from the display selects his required task which are converted and processed by virtual reality environment and then transferred into various robotics programs. The COSMIR environment then checks these programs that whether those programs when run produces the real action or not.
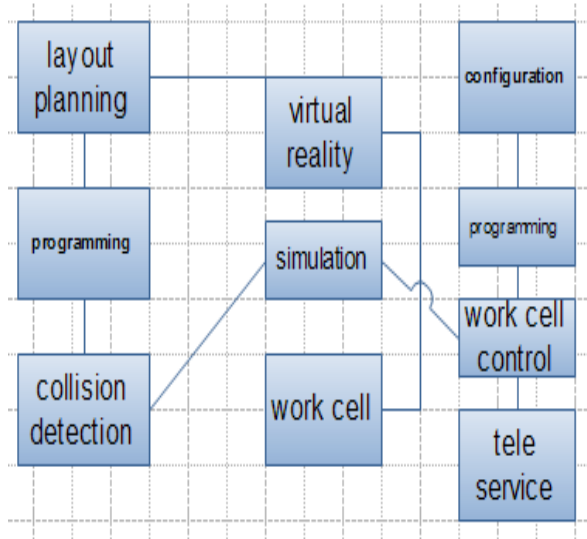
Figure- 13: Connection between simulation and control system

In the diagram shown above we see a system on the right side which is called LUCAS (Layered Universal Controller for Automation Systems), it is similar to COSMIR. The LUCAS stores the programs which are tested by the COSMIR and also monitors the complete cell. By doing this, a correct simulation is achieved. When the various tests are performed and they turn out to be successful, the LUCAS then transfers the programs into devices and then takes control of the complete cell. The step of creating programs and then transferring them into devices are repeated again and again until complete functionality is obtained. LUCAS may contain tele service components like cell phones which monitor the work cell and then may change or modify the programs (if needed).

In the latest researches a new robot was constructed which was able to unscrew the car wheels [16]. The virtual reality environment is changed accordingly to the sensor information. Programs were created for robots to specify each and every position of the screw of wheel. Similarly a robot was constructed which can do house chores like washing dishes etc.

Figure- 14: Robot washing dishes

Creation of such robots and simulations lies under the project of FA-SiCo (Factory Automation – Simulation and Control). This project involves methodologies for various simulation techniques. The main objective of this project was to show that with the development of new technologies, the development cycle of new products will be short.
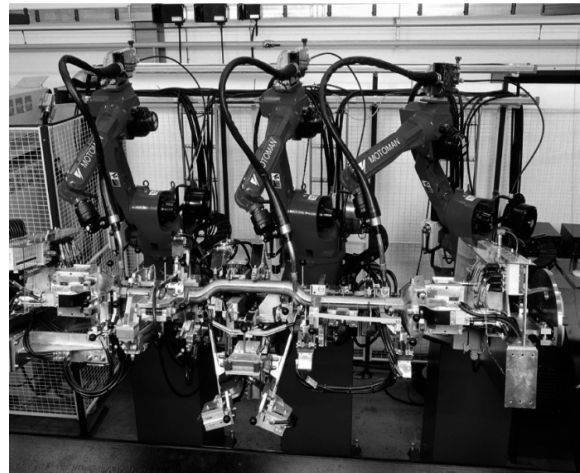

Figure- 15: Three robots welding a car

[a]   *Description of the Simulation:*

COSMIR is used for a real environment simulation. For modeling of the system the already existing libraries were used. CAD was used to create some 3D objects, and was transformed into simulation by using a tool provided by COSMIR.

[b]   *Embedding 2D Educational Simulation Games in 3D:*

The real environment simulation which is used most commonly nowadays is the best approach used for teaching and from the learning perspective. Such simulations are made by integrating different technologies but at the same time they are of much cost and require professionals to use it.

Large percentage of people which mostly includes children and adults of age 18-30 loves to play games. And since the 3D technology has been developed they prefer 3D games over games developed using 2D approach. If we see from the learning perspective we find out that students and teachers also prefer the 3D simulation games for learning process over 2D simulation because 3D simulation environment provides easy learning as compare to 2D simulation.

[c]   *3D Simulation Game C-VIBE:*

A project named VERDI (Virtual Environment for Real time Distributed applications over the Internet) was started in Europe which provided a satellite broadband internet platform for various internet application developers. Soon after this project an application was developed which is called C-VIBE which is a 3D simulation game for a business. This game is developed for the employees working in any company or for someone who wants to start a business. This game provides some techniques to how to start a business and help them during their cognition process. For this game a team of 4- 5 members is required to implement some kind of innovation in a company and all of their actions are shown virtually.

It's a business navigator helping the trainees to learn business and its basic requirements [17] . Such game EIS simulation has been already developed long time back, which has excessively been used in all business schools and different companies to teach student how to implement new changes in the already running business. EIS simulation required 6-8 members to implement a major task within 1.5-2 hours by using tools of more than one kind.

[d]   Working of C-VIBE:

The player first has to start this game and then joins any team by selecting an avatar of his own choice. This game is played by browsing its website first and then by selecting an option from the tool bar. The webpage gives virtual environment, chat box and work panel.
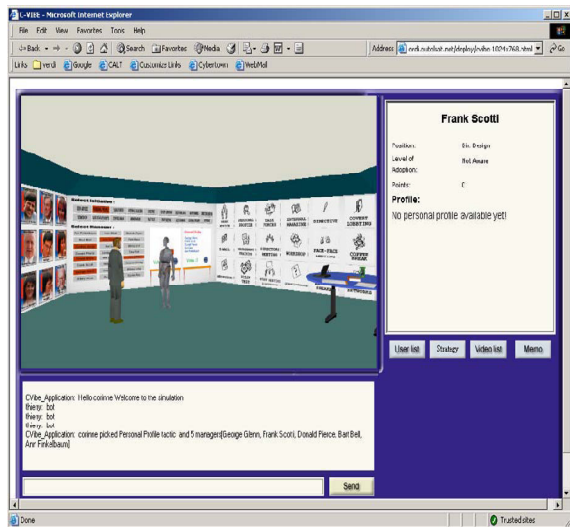

Figure- 16: Screen shot of the website

The virtual environment shown in the centre of the webpage consists of characters that have to take a task and have to implement it by taking decisions of their own choice. In the screenshot we see that characters are surrounded by set of walls showing managers of the organization to whom the player has to report, getting the information and then taking decisions to implement them. The player also has to specify that what kind of action he has taken and why?

But the question arises that how will the user know that what was the impact of his decision? For this purpose the developers of C-VIBE has developed an application of another character "assistant". [18] When the decision has been taken the assistant character then creates a small animated window showing the result of user's decision.

How will the user communicate with animated mangers and how will they implement a decision? For this developers have developed different tools, which when selected helps the user to perform the action.

[e]   Description of Application:

This application shows a client server environment that consists of 3D environment and different clients or users communicating through internet. User uses internet for communicating with the application. The application uses

java based components which provides real behavior and mode for communication.

The application also consists of the engine which provides mechanism for connecting to the server and implements the tasks performed.

[f]   Architecture:

Application consists of components that are embedded in the virtual server. In the start of the game the application takes all the important information from the engine for starting the game. Further changes takes place every time the user takes decision and performs the action.
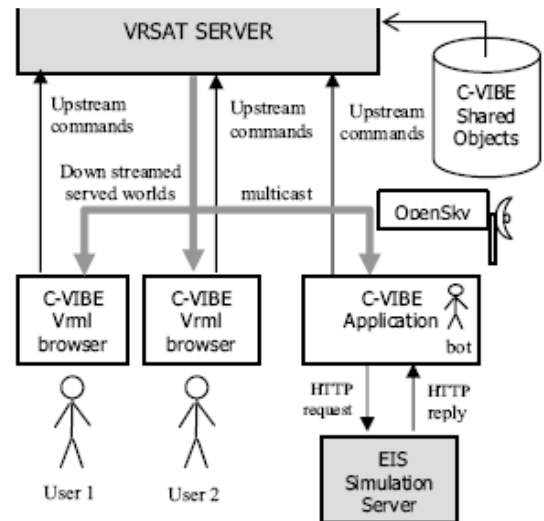

Figure- 17: C-Vibe Architecture

[g]   Design:

During the design of C-VIBE technologies like virtual environment server has been developed. As discussed previously the whole concept behind development of 3D simulation from 2D simulation environment was to promote the concept of reusability and reduce the effort for making complex systems. But also have some problems like the engine used in 3D version uses same engine of 2D version because if some changes were made in this engine then it would have created different maintainability problems.

IV.   CONCLUSION

After doing a research we have made a hypothesis that simulation and modeling have played major role in the advancement of science and made every complex thing not easy and available form. Simulation and modeling has removed drudgery and added amusements to our lives due to which human has got access to those things which once were considered unreachable and inaccessible. Thus we have concluded that day by day more and more calculations are made and new techniques are made for computations. It has overtaken many fields of science and architectures and sciences are well explained through simulation and modeling. E.g., heart simulation, flight simulation and 3D simulation for mining operator etc. Thus in general we can say that simulation and modeling has added value to science and thus

simulation is incomplete without modeling because modeling gives shape to imitated design and working of something.

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