

International Journal of Management, IT & Engineering (ISSN: 2249-0558)

CONTENTS

| Sr. No. | TITLE & NAME OF THE AUTHOR (S) | Page No. |
|------------|--|----------------|
| <u>1</u> | Empirical and Qualitative Studies by Analyzing Requirement Issues In Global Software Development (GSD). Rabia Sultana, Fahad Jan, Ahmad Mateen and Ahmad Adnan | <u>1-18</u> |
| <u>2</u> | Challenges and Opportunities of Technology Transfer Management. Armin Mahmoudi | <u>19-34</u> |
| <u>3</u> | SMEs Competitive Advantage through Supply Chain Management Practices. Prof. Gyaneshwar Singh Kushwaha | <u>35-50</u> |
| <u>4</u> | Different Issue for Handling Different Cache Strategies on Usenet. Harish Rohil and Jitender Yadav | <u>51-71</u> |
| <u>5</u> | Power Quality enhancement in MICROGRID (Islanding Mode) by Using ND - MLI DSTATCOM. M. Manigandan, MIEEE and Dr. B. Basavaraja, SMIEEE | <u>72-90</u> |
| <u>6</u> | Analysis of Optical Soliton Propagation in Birefringent Fibers. R. Samba Siva Nayak, Suman. J and Naveen | <u>91-102</u> |
| <u>7</u> | Human Resource Accounting in IT industry (A study with reference to Infosys Technologies Limited). Dr. P. Natarajan and Bashar Nawaz | <u>103-123</u> |
| <u>8</u> | Solving profit based unit commitment problem using single unit dynamic programming. P.V. Rama Krishna and Dr. Sukhdeo sao | <u>124-146</u> |
| <u>9</u> | Achieving Optimal DoS Resistant P2P Topologies for Live Multimedia Streaming using Cost function Algorithm. A. L.Srinivasulu, S. Jaya Bhaskar, Ms. K. Deepthi and Dr. Sudarson Jena | <u>147-162</u> |
| <u>10</u> | Quality of Web Sites – A Study On Some Standard Indian Universities. K. V. N. Prasad and Dr. A. A. Chari | <u>163-182</u> |
| <u>11</u> | Simulating Complex Environmental Phenomena Using Cubemap Mapping Technique. Movva. N.V. Kiran Babu, Ch. Siva Rama Krishna, M. Hanumantha Rao and V. Venu Gopal | <u>183-203</u> |
| <u>12</u> | Data Sharing and Querying in Peer-to-Peer Data management System. Jyoti Duhan | <u>204-223</u> |
| <u>13</u> | Secure File Transmission Scheme Based on Hybrid Encryption Technique. Gaurav Shrivastava | <u>224-238</u> |
| <u>14</u> | Investigating Flip-Flop Gates Using Interactive Technology. Mr. Amish Patel, Ms. Neha P. Chinagi and Mr. Hiren R.Raotole | <u>239-255</u> |
| <u>15</u> | B2B Versus B2C Direct Selling. Ankit Chadha and Er. Banita Chadha | <u>256-270</u> |
| <u>16</u> | Application And Implementation of Crm In Hotels of Developing Cities - A Case Study of Ranchi. Praveen Srivastava, Abhinav Kumar Shandilya and Shelly Srivastava | <u>271-294</u> |
| <u>17</u> | An Automatic Bacterial Colony Counter. Ms. Hemlata, Mr. Ashish Oberoi and Mr. Sumit Kaushik | <u>295-309</u> |

IJMIE

Volume 2, Issue 1



Chief Patron

Dr. JOSE G. VARGAS-HERNANDEZ

Member of the National System of Researchers, Mexico

Research professor at University Center of Economic and Managerial Sciences, University of Guadalajara Director of Mass Media at Ayuntamiento de Cd. Guzman Ex. director of Centro de Capacitacion y Adiestramiento

Patron

Dr. Mohammad Reza Noruzi

PhD: Public Administration, Public Sector Policy Making Management, Tarbiat Modarres University, Tehran, Iran Faculty of Economics and Management, Tarbiat Modarres University, Tehran, Iran Young Researchers' Club Member, Islamic Azad University, Bonab, Iran

Chief Advisors

Dr. NAGENDRA. S.

Senior Asst. Professor, Department of MBA, Mangalore Institute of Technology and Engineering, Moodabidri

Dr. SUNIL KUMAR MISHRA

Associate Professor, Dronacharya College of Engineering, Gurgaon, INDIA

Mr. GARRY TAN WEI HAN

Lecturer and Chairperson (Centre for Business and Management), Department of Marketing, University Tunku Abdul Rahman, MALAYSIA

MS. R. KAVITHA

Assistant Professor, Aloysius Institute of Management and Information, Mangalore, INDIA

Dr. A. JUSTIN DIRAVIAM

Assistant Professor, Dept. of Computer Science and Engineering, Sardar Raja College of Engineering, Alangulam Tirunelveli, TAMIL NADU, INDIA

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A. International Journal of Management, IT and Engineering http://www.ijmra.us

IJMIE

Volume 2, Issue 1



Editorial Board

Dr. CRAIG E. REESE Professor, School of Business, St. Thomas University, Miami Gardens

Dr. S. N. TAKALIKAR Principal, St. Johns Institute of Engineering, PALGHAR (M.S.)

Dr. RAMPRATAP SINGH Professor, Bangalore Institute of International Management, KARNATAKA

Dr. P. MALYADRI Principal, Government Degree College, Osmania University, TANDUR

Dr. Y. LOKESWARA CHOUDARY Asst. Professor Cum, SRM B-School, SRM University, CHENNAI

Prof. Dr. TEKI SURAYYA Professor, Adikavi Nannaya University, ANDHRA PRADESH, INDIA

Dr. T. DULABABU Principal, The Oxford College of Business Management, BANGALORE

Dr. A. ARUL LAWRENCE SELVAKUMAR Professor, Adhiparasakthi Engineering College, MELMARAVATHUR, TN

> Dr. S. D. SURYAWANSHI Lecturer, College of Engineering Pune, SHIVAJINAGAR

Dr. S. KALIYAMOORTHY

Professor & Director, Alagappa Institute of Management, KARAIKUDI

Prof S. R. BADRINARAYAN Sinhgad Institute for Management & Computer Applications, PUNE

Mr. GURSEL ILIPINAR

ESADE Business School, Department of Marketing, SPAIN

Mr. ZEESHAN AHMED

Software Research Eng, Department of Bioinformatics, GERMANY

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A. International Journal of Management, IT and Engineering http://www.ijmra.us



IJMHE

Volume 2, Issue 1



Mr. SANJAY ASATI

Dept of ME, M. Patel Institute of Engg. & Tech., GONDIA(M.S.)

Mr. G. Y. KUDALE N.M.D. College of Management and Research, GONDIA(M.S.)

Editorial Advisory Board

Dr. MANJIT DAS

Assistant Professor, Deptt. of Economics, M.C.College, ASSAM

Dr. ROLI PRADHAN

Maulana Azad National Institute of Technology, BHOPAL

Dr. N. KAVITHA

Assistant Professor, Department of Management, Mekelle University, ETHIOPIA

Prof C. M. MARAN

Assistant Professor (Senior), VIT Business School, TAMIL NADU

Dr. RAJIV KHOSLA

Associate Professor and Head, Chandigarh Business School, MOHALI

Dr. S. K. SINGH

Asst. Professor, R. D. Foundation Group of Institutions, MODINAGAR

Dr. (Mrs.) MANISHA N. PALIWAL

Associate Professor, Sinhgad Institute of Management, PUNE

Dr. (Mrs.) ARCHANA ARJUN GHATULE

Director, SPSPM, SKN Sinhgad Business School, MAHARASHTRA

Dr. NEELAM RANI DHANDA

Associate Professor, Department of Commerce, kuk, HARYANA

Dr. FARAH NAAZ GAURI

Associate Professor, Department of Commerce, Dr. Babasaheb Ambedkar Marathwada University, AURANGABAD

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A. International Journal of Management, IT and Engineering http://www.ijmra.us



IJMIE

Volume 2, Issue 1



Prof. Dr. BADAR ALAM IQBAL Associate Professor, Department of Commerce, Aligarh Muslim University, UP

Dr. CH. JAYASANKARAPRASAD Assistant Professor, Dept. of Business Management, Krishna University, A. P., INDIA

Technical Advisors

Mr. Vishal Verma Lecturer, Department of Computer Science, Ambala, INDIA

Mr. Ankit Jain Department of Chemical Engineering, NIT Karnataka, Mangalore, INDIA

Associate Editors

Dr. SANJAY J. BHAYANI Associate Professor ,Department of Business Management, RAJKOT, INDIA

MOID UDDIN AHMAD Assistant Professor, Jaipuria Institute of Management, NOIDA

Dr. SUNEEL ARORA Assistant Professor, G D Goenka World Institute, Lancaster University, NEW DELHI

> **Mr. P. PRABHU** Assistant Professor, Alagappa University, KARAIKUDI

Mr. MANISH KUMAR Assistant Professor, DBIT, Deptt. Of MBA, DEHRADUN

Mrs. BABITA VERMA Assistant Professor, Bhilai Institute Of Technology, DURG

Ms. MONIKA BHATNAGAR Assistant Professor, Technocrat Institute of Technology, BHOPAL

Ms. SUPRIYA RAHEJA

Assistant Professor, CSE Department of ITM University, GURGAON

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A. International Journal of Management, IT and Engineering http://www.ijmra.us



IJMIE

Volume 2, Issue 1





A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A. International Journal of Management, IT and Engineering http://www.ijmra.us

<u>ISSN: 2249-0558</u>

Abstract:

concepts of simulation of rain falling effects using: Delta3D Particle System Editor, which renders rain falling effect using two static raindrop textures, and Physical Properties-Based Method which renders rain falling effect by mapping the background scene onto raindrops according to their refraction property. We observe that the reflection property of a raindrop is also important since it contribute to its visibility in the dark regions. Hence, we propose a new method that takes into account both refraction and reflection property of raindrop, increase in the computational speed of graphics hardware in recent times. This power afforded by modern graphics cards enables the possibility of simulating complex environmental phenomena.

1. Introduction:

Special Effects, especially atmospheric effects such as rain, cloud, snow and other outdoor scenes in interactive applications (video games, training systems...) are important in creating realistic environments. As current graphics hardware's computation speed is improving, their high degreeof realism is also required to immerse the user in a visually convincing environment. However, rendering these effects is a hard problem, especially in real time.Rain is a complex atmospheric physical phenomenon and consists of numerous visual cues. There are different forms of rainfall like light, moderate, heavy, and extremerainfall. The falling of raindrops is commonly and easily seen in the environment, than its effectafter it hits the ground. Whenever falling raindrops hit the surface of the ground, it causes two effects: water rippling and splashing of raindrop. During rain, all raindrops are merged togetherand form a stream of water on the streets and objects.

1.1 Rain Rendering

In general, Particle Systems are used to generate rain in many video games by using particles falling vertically from the sky. Each particle is a translucent white streak. This may be a segment geometrically composed of two points, or approximated by a texture plated on a rectangle stretched vertically commonly called billboard). The second technique has an advantage of allowing different drop sizes depending on the depth relative to observer, unlike the use of

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A. International Journal of Management, IT and Engineering http://www.ijmra.us

IJMIE

Volume 2, Issue 1

<u>ISSN: 2249-0558</u>

segments which have a fixed width whatever their position in the scene. Langer et al. [1] presented interactive an image-based spectral synthesis method to render snow and rain. The proposed method that is a combination of a Particle System and a spectral analysis technique, which creates a dynamic rainy or snowy environment texture. The spectrum of the falling snow or rain texture is defined by a dispersion relation in the image plane. presents a result obtained by this methodWang and Wade [2] presented a technique that maps textures onto a double cone which is placed around the observer as shown by the left image in The orientation of cones is determined by the position and speed of camera movement. Several textures of rain and snow are simultaneously scrolled on the double cone with different speed to give a motion impression.

This technique is faster than Particle System, but does not allow any kind of interaction between particles and their environment, whether physical interaction (bounces and other forces applied to particles) or optical (refraction and reflection of the scene visible in the drops). Besides, the textures must be drawn by artists for all the conditions shown in the scene taking into account the density of precipitation and level of brightness of the scene in which the textures will be used.

ATI and Nvidia have integrated programs including a simulation of rain in their software development kits to illustrate the possibilities of their hardware. The figures present the comparison of the results obtained by ATI and Nvidia respectively. ATI was the first to publish a demo, called Toyshop Demo, of a rainy night in a city. This demo contains various effects detailed in [3], [4], and [5]. Among these effects, the rain simulation interests us the most. The technique is based on a post-processing image-space technique, in which the rain is added once the rest of the scene was rendered. Several layers of raindrops are simulated with different speeds at varied depths in a single rendering layer in order to get a feeling of raindrop motion parallax (a strong visual cue in any dynamic environment). The fact that the animation takes place at night, and therefore with a low intensity enables not to bother with simulating refraction and reflection in the drops. Hence, the used textures which contain a constant stain and intensity are modulated by the intensity of a global luminous scene. This enables a realistic interaction of rain with the lightning which shortly lightens the scene from times to times. The demo also contains a simulation of raindrops falling off objects, for example raindrops pouring from a gutter pipe or falling off the rooftop ledge. Drops are simulated as independent particles and animated using graphics hardware of the method described in [6]. Finally, this demo takes into account the splashes coming from drops collision with a wet surface. The positions of the collisions are

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A. International Journal of Management, IT and Engineering http://www.ijmra.us

IJM

Volume 2, Issue 1

<u>ISSN: 2249-0558</u>

random and uncorrelated with the positions of the parallax planes that contain the falling drops. The rendering of the splashes is done by pre-rendering a high-quality splash sequence for a milk drop. This sequence is then deformed to avoid obvious similarities between apparent splashes, and afterward played step by step at each splash position. Nvidia also proposed a demo of rain with its software of development kit for DirectX 10 to illustrate the possibilities of its models Geforce 8. The demo is detailed in [7] and uses databaseof images created by [8]. Some parameters have been eliminated and the database was restricted to 300 textures. Some of the textures, the angle of viewpoint and the light direction are selected and interpolated to render raindrop particles. This demo uses a night scene and only the interaction with light is simulated. It does not take into account the refraction and reflection of the raindrops appearance.

1.2 Problem Statement

The main objective of the project is to create realistic rain falling effect taking into account the refraction and reflection of raindrop by modeling the world as a cube map, and using environment matting techniques. Unfortunately, this takes a lot of computation to render an image. Hence, We also focus on optimization running time of this technique in order make this effect run in real-time (which means the number of image or frame generated per second (frame-rate) is greater than 20).

1.3 Our Contributions

Our contributions toward this project are :

1. We implemented a new method of creating realistic rain falling effect in Delta3D. It is a physically-based method and mainly based on cube maps and environment mappingtechniques.

2. We optimized Matlab's codes of environment mapping technique and converted them intoC++ code. This causes realistic rain falling effect run in real-time with more than 10000raindrops in the scene.

3. We also implemented a new method of making streak raindrops based on our raindropmodel. This makes our rain effect look more realistic.

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A. International Journal of Management, IT and Engineering http://www.ijmra.us

IJMH

<u>ISSN: 2249-0558</u>

4. We generated maps which can be used in Delta3D, and also for other purposes of creatingrealistic rain falling in animation movies, training systems, PC games, PS3 games, or othersimulations.

5. The proposed method above can be considered as an extension to existing environmentmapping technique [9] as follows:

(a) Many objects can be moved in the scene

(b) View point (camera) can freely be rotated in the scene

(c) View point can be moved in the scene

(d) Rendering a photorealistic image of resolution 512x512 takes less than 0.05 second, thus rendering time of moving objects in the scene can be done in real-time.

2. Delta3D:

Delta3D [10][11] is an Open Source engine which can be used for games, simulations, or othergraphical applications. Its modular design integrates other well-known Open Source projectssuch as Open Scene Graph [12], Open Dynamics Engine [13], Character Animation Library [14], and OpenAL [15] as well as projects such as Trolltech'sQt, Crazy Eddie's GUI (CEGUI), Xerces-C, Producer, InterSense Tracker Drivers, HawkNL, and the Game Networking Engine (GNE). It has a high-level, cross-platform (Win32 and Linux) C++ API designed with programmers inmind to soften the learning curve, but always makes lower levels of abstraction available to thedeveloper. Programmers can develop content through the level editor-they can write Pythonscript to the Delta3D API or to the underlying tools directly. Delta3D uses the standard LesserGNU Public License (LGPL) [16]. It's completely modular and allows a best-of-breed approachwhereby any module can be swapped out if a better option becomes available. Below figure showsthe Delta3D architecture. All the products in the bottom layer are existing open source projects.Delta3D unifies them into one consistent API with associated tools.

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A. International Journal of Management, IT and Engineering http://www.ijmra.us



Volume 2, Issue 1

<u>ISSN: 2249-0558</u>



2.1 Effect in Delta3D

Delta3D contains many effects such as motion models (Fly, UFO,Walk, Orbit, and First Person), smoke, explosion, animation blending, and particularly Graphical Particle Effect Editor. This editor allows developers to use graphical tool to change the properties of a particle system and see the effects immediately in real time.

2.2 Using Delta3D Particle System Editor

The principal concept of this method is to first create a texture of a raindrop and map it on asmall billboard (particle) that will always face the viewer (camera). Then, a rectangular emitteris made to shoot randomly particles straight down from a particular height. Some properties of a particle have to be set, such as, life of drop (for example 2 seconds, it's best to have raindropsdisappear when they hits the ground), size of drop (or particle, for example from 0.15mto 0.25m), various numbers of particles creation (for example from 150 particles/sec to 200particles/sec), and initial velocity rang of drops (for example from 6 m/s to 10 m/s) so thatraindrops don't fall at regular rates, numbers, and patterns. Even though the particles aresupposed to be random, most people will notice a pattern after a while. So finally, to further

stop this from happening, emitters (or layers) have to be created by putting different numbersinto these emitter's properties and especially making different raindrop textures. Whenever a raindrop hits the wet surface of flat area such as the surface of the water in pool, circular of ripple (water ring) will occurs. This effect can be made by this particle system editorin a similar manner. At

IJM

Volume 2, Issue 1

<u>ISSN: 2249-0558</u>

first, texture of water ring has to be mapped to a particle that alwayslay flat on the ground. Then a rectangular emitter is made to shoot randomly particles butthe velocity shooting has to be set to zero in order to keep the particle from floating upwards.Lastly, the size of particle (or water ring) has to be set from 0m to 0.16m so that enlargementof water ring can be seen.These textures and a simple terrain are used in the particle system editor whose properties areset with the example values mentioned aboveThis method allows user to have the impression of a rainy environment, but it's not very realistic.This is because of the rain is rendered using two static texture of raindrops, whose colorsare independent to the environment.

2.3 Using Physical Properties-Based Method

This method is based on physical properties (geometrical, dynamic and optical) of raindrops.Ross [19] proved that falling raindrops look more like ellipsoids. Small raindrops are almostspherical, and bigger raindrops get fattened at the bottom. Beard and Chuang [20] [21] gave a10th order cosine distortion on a sphere as a means to reproduce raindrop shapes:

$$r(\theta) = a \left[1 + \sum_{n=0}^{10} c_n \cos(n\theta) \right]$$

The basic concept is capturing an image of the background scene to a texture. Later, this texture mapped onto the raindrops according to optical laws (Only Snell's law). Since it takes into account the refraction of raindrop, its result is much more realistic than the previous method. However, since thismethod doesn't take care of the reflection of raindrop, raindrops will not be seen in the darkarea, for example, when the scene camera looks at the dark sky while the ground is lit. In this case, raindrops are visible because the appearance of raindrops is influenced by the reflection law that causes the color on the border of the drops look like the ground

A photograph of the original scene was used as a backgroundimage for the simulated drop. The bottom images show a close view of the original and simulated drops. As the real drop just left the tap, its shape is not yet stabilized and is notperfectly spherical, and so it does not behave exactly as the simulated one. The image that wesee inside the drop is upside down or inverted image because drops act like convex lens.

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A. International Journal of Management, IT and Engineering http://www.ijmra.us

3. Using Cube Map and Environment Mapping:

Environment mapping is a rendering technique used to create photorealistic images of an objectby mapping the environment on the object according to its property. This technique can bedone by using a cube map that contains six faces which are mapped by six images captured fromthe scene surrounding the object. It is useful because of the fact that rendering a transparentobject, which is reflective and refractive, by ray tracing can be very expensive, whereas environmentmapping render it more cheaply with little loss of accuracy. So the main point of thismethod is to map the environment on each raindrop. This takes into account both refractionand reflection of raindrop. The following subsections present three primary functions of the environment mapping [9]:Pattern Generation, Map Generation and Relighting and Compositing, our main method ofmaking realistic rain falling, making a streak raindrop, and the final algorithm.

3.1 Three Primary Functions

Pattern Generation, this function is used to make unique color code for each pixel of the cubemap by generating patterns. Patterns are projected on six faces of the cube for finding the map.Number of patterns depend on the number of pixels in the cube and number of colors used forcoding the pixels. They are generated by the following formula:

$$\lceil \frac{\log(|\text{Pixels}|)}{\log(|\text{Colors}|)} \rceil = \lceil \frac{\log K \ge K \ge 6}{\log c} \rceil$$

whereKxK is the resolution of a cube face. For example, the number of patterns required for acube map (with each face) of resolution 512x512 and 3 colors for coding is 13.Map Generation, this function generates a map, stores the location and fraction of the contributing pixel on cube map, by checking each pixel color of the input images. These input images

are created by rendering of object A, at location X, in the cube whose six faces are mapped with generated patterns. Since patterns contains unique color codes, so does the created inputimages. According to these codes, contribution pixels on cube map can be found. Relighting and

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A. International Journal of Management, IT and Engineering http://www.ijmra.us

IJMH

Volume 2, Issue 1

<u>ISSN: 2249-0558</u>

Compositing, this function use the generated map to get new good quality imagesby rendering object A at location X in the cube whose six faces are mapped by six imagescaptured from any scenes. Once we get the map of object A, we use that map to render it in a new real world environment see how the beautiful illumination effects created by refraction or reflection caused by object A. Top left and right are rendered image without zooming. Bottom left and right are rendered image with 50 times zoom in.



3.2 Our Technique

Our technique is primarily based on the aforementioned three functions, Pattern Generation, Map generation, and Relighting and Compositing. It has two steps: pre-processing step andprocessing step. In pre-processing step, we make an imaginary "huge" cube and set the camera (the viewpoint) in the middle of it. The huge cube is then divided into L layers and each layer are divided into R rows and C columns, so we can imagine that we have L*R*C small cubes inside that hugecube. Afterwards, we use Pattern Generation and Map Generation togenerate maps of a raindrop put in the middle of the small cube one by one. Eventually, weget M*R*C maps which are used in processing step. All theses maps are indexed from one toM*R*C according to the position of small cubes so that we can easily find them.In processing step, we capture six images of the scene and mapped these images on six facesof the huge cube. Then we check position of each raindrop and used the correspond map torender those raindrops. For example if a raindrop positions in a small cube numbered three thanthe map numbered three is used by Relighting and Compositing function to render that raindrop.

Capturing six imges of the scene: we use a second camera which is positioned at the samelocation as the primary camera (observer) and directed parallel to the ground. Field Of

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A. International Journal of Management, IT and Engineering http://www.ijmra.us

IJMH

Volume 2, Issue 1

<u>ISSN: 2249-0558</u>

View(FOV) of the camera is set to 900. Front, left, right, top, down, and back image are generatedby capturing the scene after the camera is rotated 00, 900 to left, 900 to right, 900 to up, 900 todown, and 1800 to up respectively.Movement of the camera: wherever the camera moves (forward, backward, leftward, rightward,upward, downward), the cube is also moved along with it since we want that camera tobe always located in the middle of the cube. This is because all the maps are generated whenthe camera is only positioned in the middle of the huge cube in pre-processing step. Besides,when the camera is changed from a position A to a new position B, six images of the scene haveto be recaptured so that raindrops are looked reasonable in the scene by rendering with thesenew images. But, when it is rotated, the scene needs not to be recaptured.Thescene contains a blue object, a red object, and a raindrop. In reality, if the raindrop is seen from the position B, it appears red; if that raindrop is seen from the position B, it appears blue.

our technique shows the movement of camera from positionA to B. In bottom left image, the camera is positioned at A and the raindrop looks redsince it is primarily contributed by the red color which is on the huge cube. In bottom rightimage, when the camera is moved to B, the huge cube is also moved along with it and the sceneis recaptured so that the raindrop looks blue.

3.3.3 Making Streak Raindrop

Making rain falling effect as mentioned above is a physically-based method, thus all the raindropslook like spherical or ellipsoidal. Even though these raindrops are physically correct, theyseem to lack realism since human eye actually see raindrops like streaks. This is because ofhuman's retina which takes about 70 ms to form an image and raindrop moves very quickly.During that time, the raindrop keeps falling, and all its different positions compose a continuoussequence of images on the retina.Since the streak is the result of one moving drop, we used an image of our raindrop model

to make a new vertical streak image as follows (Fig 3.11):

- 1. Compute a mean of each pixel column of a raindrop to get a row of mean values
- 2. Use this row to make a streak
- 3. Lower alpha value in order to blur the streak

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A. International Journal of Management, IT and Engineering http://www.ijmra.us



4. ALGORITHM

Pre-processing step:

- 1: Generate patterns
- 2: Map these patterns on the huge cube
- 3: for Each small cube in the huge cube do
- 4: place a raindrop in the middle of the small cube
- 5: camera direction is looked at the raindrop
- 6: camera field of view is decreased to see only the raindrop

7: render an input image

8: end for

9: Generate L*R*C maps using these input images

Processing step:

- 1: Load maps generated in pre-processing step
- 2: Capture 6 images of surrounding environment
- 3: for Each particle that is visible to camera do
- 4: Get the particle position
- 5: Check the particle if it is inside which small cube using its position
- 6: if The small cube is not already used then
- 7: Compute raindrop texture (raindrop color) using captured images

and a map correspond to the small cube

- 8: if Streak raindrop is enable then
- 9: Compute streak raindrop texture using raindrop texture above

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A. International Journal of Management, IT and Engineering http://www.ijmra.us



10: end if

- 11: Store this texture in memory
- 12: Mark that small cube as used
- 13: else

14: Load raindrop texture (raindrop color) from memory

- 15: end if
- 16: Map this texture to the particle
- 17: end for

4.1 **Optimization**

After checking the existing Matlab codes of three primary functions Pattern Generation, MapGeneration and Relighting and Compositing, it's seemed that the map structure and some parts of the codes can probably be optimized to gain computation speed. Hence we restructure themap and modify some codes, particularly Relighting and Compositing function's codes. As aresult, running time of modified function improves much over the original function. Since these three functions are needed for our implementation in C++, we converted them to C++ codes.Interestingly, the new result of computation time is pretty fast. Both output result (outputimage) of Matlab and C++ functions are the same. Detailed result of our experiment is shownbelow:

The following are our assumption which is used by original Matlab, new Matlab, and c++ codes.

The number of reflection + refraction is 4 because we did the same experiment by varying that number from 1 to 10 and the result images of setting number from 4 to 10 are look exactly thesame.

- Resolution of each cube face, input images, and output image: 512x512
- Number of colors for making unique color codes: 3
- Number of refraction + reflection: 4

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A. International Journal of Management, IT and Engineering http://www.ijmra.us

IJMH



The following is the result of original Matlab code:

- Map computation : 70 seconds (average)
- Relighting and Compositing : 30 seconds (average)

We modified the original Matlab codes using two steps:

1. By changing the map format and partly modifying codes in Map Generation and Relighting and Compositing function in order to use the new map, we got the following result:

- Map computation : 80 seconds (average)
- Relighting and Compositing : 20 seconds (average)

2. By optimizing the first step, that is modifying main part of the codes in Relighting and Compositing function, we got the following result:

- Map computation : 75 seconds (average)
- Relighting and Compositing : 1 seconds (average)

Finally, we converted Malab codes into c++ codes and got the following result:

- Map computation : 2 seconds (average)
- Relighting and Compositing : 0.04 seconds (average)

4.2 Creating Rain Falling Effect

To facilitate our implementation, particle system of OpenSceneGraph integrated in Delta3D is used to make falling raindrops. Practically, no particle system generate raindrops, but particles whose properties such as position, size, color, and visibility are controllable. So we can change their color to a reasonable raindrop color using cube map and environment mapping. We modified some properties of particle system to shoot randomly particles straight down from

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A. International Journal of Management, IT and Engineering http://www.ijmra.us

IJM

the top of huge cube. These particles are generated inside the huge cube, at least 2 meters awayfrom camera, and move along with camera.

4.3 Result

All the result images are rendered in Delta3D on a PC with Dual-Core Intel CPU 1.86GHzprocessor with 2GB RAM. Our rain falling effect can be run in real-time in a scene with 10000 drops or streak drops we can clearlysee different between randrops on the top and bottom corner because of the refraction property fraindrop. Since raindrop have reflection property, we can also see the light brown color, which is contributed by brown color of the ground, on the border of raindrops. In the same situation, raindrops rendered by Physical Properties-Based Method will not be visible since it doesn't take into account the reflection property of raindrop.

5. Conclusion and Future Work:

We created rain falling effect using Delta3D Particle System Editor that allows the user to have the impression of a rainy environment, but it's not very realistic. We proposed a new method togenerates visually convincing results of rain falling using Cube Map and Environment Mapping, which is a rendering technique used to create photorealistic images of an object by mapping the environment on the object. Results of this method are more realistic than the other two methodsusing: Delta3D Particle System Editor, which renders rain falling using two static textureof raindrops whose colors are independent to the environment, and Physical Properties-BasedMethod, which renders rain falling by mapping the background scene onto raindrops accordingtheir refraction property. We highly optimized the original Matlab codes of environmentmapping by modifying map format and main part of the codes in Relighting and Compositingfunction. We also converted the optimized Matlab codes into c++ whose computation time ispretty fast. We proposed a new method of making streak raindrops based on our raindropmodel. Finally, we implemented our new methods in Delta3D modifying its particle system torender reasonable raindrop textures instead of particles. In future work, our method can be implemented in Graphics Processing Unit, which is very efficient at manipulating and displaying computer graphics, in order to render more than 10000raindrops in real-time. It can also be improved to handle collisions of the raindrops with the ground or objects in the scene.

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A. International Journal of Management, IT and Engineering http://www.ijmra.us



6. **Bibliography:**

- M. S. Langer, L. Zhang, A. W. Klein, A. Bhatia, J. Pereira, and D. Rekhi.A spectralparticlehybrid method for rendering falling snow.In Rendering Techniques 2004 (EurographicsSym-posium on Rendering). ACM Press, june 2004.
- N.Wang and B.Wade. Rendering falling rain and snow.In ACM SIGGRAPH 2004 TechnicalSketches Program, 2004.
- N. Tatarchuk. Artist-directable real-time rain rendering in city environments.In Proceedingsof Game Developers Conference, 2006.
- N. Tatarchuk. Artist-directable real-time rain rendering in city environments. In Proceedingsof the 2006 Symposium on Interactive 3D graphics and games Poster, page 30, New York,NY, USA, 2006. ACM Press.
- N. Tatarchuk and J. Isidoro.Artist-directable real-time rain rendering in city environments.In Eurographics Workshop on Natural Phenomena, New York, NY, USA, 2006.ACM Press.
- P. Kipfer, M. Segal, and R. Westermann.Uberflow : A GPU-based particle engine. In Proceedings of ACM SIGGRAPH/EUROGRAPHICS Symposium on Graphics hardware, pages115-122, 2004.
- S. Tariq. Rain. Technical report, Nvidia, 2007.
- K. Garg and S.K. Nayar.Photorealistic Rendering of Rain Streaks.ACM Trans. on Graphics(also Proc. of ACM SIGGRAPH), July 2006.
- BiswarupChoudhury, DeepaliSingla, SharatChandran. Fast Color-Space decompositionbased Environment Matting. In Proceedings of the 2008 symposium on Interactive 3D graph-ics and games, pages 1-1. ACM, 2008.
- Delta3D. www.delta3d.org, last viewed on June, 05 2008.
- Rudy Darken, Perry McDowell, and Erik Johnson. Projects in VR: the Delta3D open sourcegame engine. Computer Graphics and Applications, IEEE, Vol.25, Iss.3, May-June 2005.
- Open Scene Graph. http://www.openscenegraph.org/, last viewed on June, 05 2008.
- Open Dynamics Engine. http://www.ode.org/, last viewed on June, 05 2008.

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A. International Journal of Management, IT and Engineering http://www.ijmra.us

JM

- 3D Character Animation Library. https://gna.org/projects/cal3d/, last viewed on June, 052008.
- OpenAL,Cross-Platform 3D Audio. http://www.openal.org/, last viewed on June, 05 2008.
- GNU Lesser General Public License. http://www.gnu.org/licenses/lgpl.html, last viewed onJune, 05 2008.
- Falling Rain Particle Effect. http://www.delta3d.org/filemgmt/visit.php?lid=80, last viewedon June, 05 2008.
- Pierre Rousseau, Vincent Jolivet, DjamchidGhazanfarpour. Realistic real-time rain rendering.Computers & Graphics 30, 4 (2006), 507-518. special issue on Natural PhenomenaSimulation.
- Ross, O.N. (2000) Optical Remote Sensing of Rainfall Microstructures, FreieUniversit⁻⁻atBerlin, FachbereichPhysik, Diplom Thesis, 134pp.
- Chuang C, Beard KV. A new model for the equilibrium shape of raindrops. Journal of Atmospheric Science, 44(11):1509-1524, 1987.
- Chuang C, Beard KV. A numerical model for the equilibrium shape of electrified raindrops. Journal of Atmospheric Science, 47(11):1374-89, 1990.

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A. International Journal of Management, IT and Engineering http://www.ijmra.us