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VIRTUAL TOUR OF CORAL REEFS

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This report is submitted in partial fulfillment of the requirements for the
Bachelor of Computer Science (Interactive Media)

FACULTY OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
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2005

DECLARATION

I hereby declare that this project report entitled

VIRTUAL TOUR OF CORAL REEFS

is written by me and is my own effort and that no part has been plagiarized without citations.

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ABSTRACT

Major threats to coral reefs are water pollution from sewage and agricultural runoff, dredging off the coast, careless collecting of coral specimens, and sedimentation when silt or sand from construction or mining projects muddies the waters of a reef and kills coral, which needs light to live. This project proposes an alternative solution to this problem through establishing a virtual reality installation that is interactive and evolving, enabling many visitors to discover the reef through high quality immersive entertainment. The project has implemented the customary process of multimedia authoring to assure the best possible outcome. The phases include Planning, Storyboarding, Design, Development, Testing, Continuance and Delivery. From the research done, it was found that the virtual reality technology can and is suitable to efficiently promote the unique characteristics of coral reefs without physically damaging it. The output of the project is an interactive application where coral reefs habitats are presented using virtual application. The coral reefs simulation can be experienced visually in the three dimensions of width, height, and depth.

ABSTRAK

Ancaman yang paling hebat bagi habitat terumbu karang ini ialah pencemaran air akibat daripada kumbahan dan pembuangan daripada aktiviti agrikultur, aktiviti pengorekan sepanjang pantai, kelalaian semasa pengutipan specimen terumbu karang dan mendapan tanah akibat projek perlombongan atau pembangunan yang menyebabkan air laut menjadi keruh lalu membunuh hidupan ini yang memerlukan cahaya untuk hidup. Projek ini membentangkan satu penyelesaian alternatif kepada masalah ini melalui pembangunan suatu installasi berasaskan realiti maya yang bersifat interaktif. Installasi ini membenarkan pelawatnya menjelajah ke kawasan terumbu karang ini hiburan yang asyik. Projek ini telah menggunakan metodologi rutin bagi membangunkan projek multimedia supaya hasil yang terbaik dapat dihasilkan. Fasa-fasa yang terlibat adalah Perancangan, Papan Cerita, Mereka, Pembangunan, Pengujian, Pembaikan dan Penghantaran. Hasil daripada kajian yang dijalankan mendapati bahawa teknologi realiti maya boleh dan sesuai untuk diaplikasikan bagi tujuan memperkenalkan keunikan hidupan ini kepada orang awam tanpa menyebabkan ancaman secara fizikal. Hasil akhir projek ini adalah suatu aplikasi interaktif dimana habitat terumbu karang dipersembahkan menggunakan aplikasi maya. Simulasi terumbu karang ini dapat dirasai dalam bentuk visual melalui aplikasi tiga dimensi.

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CHAPTER I

INTRODUCTION

1.1 Introduction

Coral reefs are one of the rare beauties of the world. They are warm, clear, shallow ocean habitats that are rich in life. The coral provides shelter for many animals in this complex habitat. These creatures that roam the depth of the ocean create a different world under the sea. Tourism is currently the main commercial use. Its increases will substantially present a major conservation and preservation problem to the reefs.

This paper proposes a solution to this problem through establishing a virtual reality installation that is interactive and evolving, enabling many visitors to discover the reef through high quality immersive entertainment. It considers the technical implications required for general reef habitats, a mixed reality environment, artificial life, user interactivity, and hardware interfaces.

Virtual reality is an interactive experienced visually in full real-time motion. Some research will also be done on Immersive and Non-Immersive types of virtual reality.

Besides that, there will also be some research on the type of sea creatures that roams the coral reefs habitat, the movements and structures of the creatures to best model the 3D objects of these creatures and its movements using the assisting tools proposed.

1.2 Project Background

The great diversity of marine habitats can be divided into three major groups - coral reefs, sea grass beds, and mangroves. Each of these three habitat groups work together to create a healthy marine environment. Increasing pressure to develop economic and recreational entities within the coastal zone, as well as more efficient harvesting of marine products has intensified the need for reliable information on the extent and status of marine resources. Only with this information will proper management of these marine resources be possible.

“The coral reef ecosystem is a diverse collection of species that interact with each other and the physical environment. The sun is the initial source of energy for this ecosystem. Through photosynthesis, phytoplankton, algae, and other plants convert light energy into chemical energy. As animals eat plants or other animals, a portion of this energy is passed on.” (*Corals and Coral Reefs, 2000*)

Whilst the true objective of this project is to install a strong sense of conservation and preservation to the future visitors of the coral reefs, it seeks to apply it through an “Immersive role-play” educative model with real time interactivity. Thus, the objectives of this project are simple – give the visitor an experience that they constructed for themselves, immerse them in wonder and inspiration, give them a reason to care and in their minds really take them there.

1.3 Problem Statement

Coral reefs are more than just wonders of underwater architecture. They are an important source of tourist money for many countries. Besides that, they protect

shorelines from storm surges and soil erosion. But by exploiting these advantages, humans have endangered many of the world's reefs. Careless water recreationist damage reefs. Divers and snorklers that stand on, sit on, or handle corals can injure the delicate polyps. Therefore there is a need for an alternative to snorkelling.

Increasing pollution, urban development, mining activities, deforestation and destructive fishing are endangering the coral reef and its fish diversity. With the development of this project, it is hoped that it is able to capture this unique diversity in the most realistic way for the benefit of the future generation.

1.4 Objectives

- a. To be able to simulate the environment of coral reefs.
Research on structure and anatomy of reefs, reefs environment and adaptations, its ecosystem and other coral reefs citizens are aimed to simulate the environment of this habitat.
- b. To provide facts of the coral reefs through interaction by the user.
User will also be able to click on a sea creature and a 2d image will appear to show a picture of the animal including facts about it.

1.5 Scope

Invariably, the choice was made to focus on technologies that are specific to VR and reefs environment at the expense of creating a similar environment. The environment created will be of a diver's point of view.

However, this project will not include every coral reefs exist in the world; nevertheless its focus is only in a continent. The continent will be chosen in the fore coming chapters where after some analysis are done.

The output is targeted to the public of all ages while the industry targeted is the tourism industry. It will be running on Windows platform.

The scope of works for this project will implement the customary process of multimedia authoring which consists of several phases. The phases are planning, storyboarding, design, development, testing, continuance and delivery.

The five main software that will be used to develop this project is the Adobe Photoshop, 3ds Max, EON Studio, Macromedia Flash and Macromedia Dreamweaver.

Adobe Photoshop will be used to create graphic images for texture mapping purposes in the 3D Studio Max.

The 3ds Max software will be used to model the basic skeleton of the sea creatures. With texture mapping function, a more realistic 2d image can just be mapped on top of the basic skeletons modelled. This could reduce the number of polygons that will affect rendering time and latency during interactivity in virtual reality.

EON Studio is a complete visual authoring tool for creating 3D interactive applications. This software will be used to create the interactive applications required in this project.

The Macromedia Flash software is used to design the main menu and other interfaces for this project besides the VR environment. These interfaces are then imported into Macromedia Dreamweaver to create html files.

1.6 Project Significance

From the early graphical applications such as flight simulators, to today's stunning special effects in movies, computer graphics have had a significant impact upon the way computers have been used to represent and visualize the world.

Consequently, visualization is a crucial communication and analysis tool in the design and simulation of many new products or systems. In the field of medicine, visualization has the potential to radically change the way that health is administered, and significant progress has been made to date. Now we are using this powerful technique to capture the unique diversity of coral reefs which can act as conservation purposes.

Moreover, this application also develop new approaches for interacting with the reefs and other marine life without physically touching them and risk damaging the habitat.

Besides, virtual reality environments can greatly enhance the way that users analyze data or objects, or navigate a virtual world. This could bring a whole new look and feel of the coral reefs to the eyes of divers and the public. This fact alone stands independent as a strong reason to the significance of developing this project.

1.7 Expected Output

The output of the project is an interactive educational type of application where coral reefs habitats are presented using virtual application. The environment created will be of a diver's point of view.

The outcome will be a simulation of a coral reefs environment that can be experienced visually in the three dimensions of width, height, and depth.

Much of the seaweed, plankton, coral and other movable plant/marine life are simulated and respond dynamically to water currents and movements of other life in a realistic manner.

1.8 Conclusion

This application has been designed with the forethought of being able to use the virtual reality technology as a generic shell to enable stories of the coral reefs to be told.

Because many coral reef organisms can tolerate only a narrow range of environmental conditions, reefs are sensitive to damage from environmental changes. Corals are susceptible to diseases and bleaching. Also, dramatic natural events such as hurricanes can damage coral reefs. In addition, many problems to reefs are anthropogenic or caused by human. Because of the important ecological and economic roles coral reef communities fulfil, an understanding of the stresses and dangers to the reefs is necessary. Fortunately, many of the human induced hazards to coral reefs can be remedied.

There are a great number of threats to coral reefs, and most of the threats can be attributed either directly or indirectly to humans. Work must be done quickly to protect our threatened resources. The list of solutions to the many coral reef problems is extensive. These range from better methods of development in order to decrease runoff to the installation of permanent moorings at heavily used anchorage sites. Whatever the solutions, adequate enforcement are needed to ensure proper techniques are being followed.

Unfortunately, enforcement has not been great enough in the past and will probably not be in the future. Therefore, the education and cooperation of people throughout the world is necessary if coral reefs are to survive.

With the development of this project, it is hoped that the public – divers or not will appreciate this habitat and realize how crucial it is to preserve it.

CHAPTER II

LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1 Introduction

“New technologies do not appear from nowhere as a mystical spark of inspiration from the mind of one individual. Nor are they inevitably accepted for their self-evident benefits. A technology emerges through a process involving broader cultural, linguistic, institutional and technological contexts. One clear illustration of this process can be drawn with the appearance of “virtual reality” in 1989, and the subsequent popularization of the idea through the media.” (*Chesher, C., 1984-1992*)

The research done is divided into two main categories. The technical background portion is research on the virtual reality technology itself while the research on coral reefs, its habitat and anatomy structure is the second category of the research.

Besides that, the software and hardware required for this project is also stated in this chapter of the report.

Multimedia design and development is a complex proposition. A healthy multimedia production process is tailored to the type and scale of the individual project. The methodology that will be implemented in the development of this project is the process of multimedia authoring which consists of several phases. The

application of this methodology for this particular project is elucidated in detail in the Project Schedule part of this report

2.2 Facts and Findings

The first portion of this report presents a review of virtual reality technology from the general perspective, that is, the advent of this technology, its usage and applications, devices and requirements that are imposed on the user in order to interact with a virtual environment.

Whilst, the second part are findings on types of reefs, reefs' anatomy and structure, its habitats and threats endangering this species.

2.2.1 Technical Background

This part contains the sub topics that were research on the virtual reality technology. As opposed above, the sub topics are Introduction to Virtual Reality, Immersive and Non-Immersive VR, Virtual Reality Applications and lastly, Virtual Reality Problems and Constraints.

2.2.1.1 Introduction to Virtual Reality

Virtual reality conjures up visions of people wearing strange looking helmets and bizarre gloves. They gesture wildly in space, turning and twisting their heads to see unknown visions. The term virtual reality (VR), first coined by Jaron Lanier back in 1989, refers to a computer-generated, interactive, 3D environment (*Lanier, J., 1998*). There have been several terms used to label this new technology. Myron Krueger used the term artificial reality to refer to environments generated by computers

(*Krueger, M.*). Virtual environments and virtual worlds refer to worlds which exist entirely within the memory of a computer. Telepresence allows the user to experience a real but remote environment that would ordinarily be dangerous or difficult to experience in real life. Telerobotics and video teleconferencing are other examples of such technology. Cyberspace was described as a computer environment spanning multiple computers, users, and data, forming a consensual hallucination that spanned the globe.

“VR actually can be classified into three stages -- passive, exploratory, and immersive. Passive VR refers to experiences that most people are familiar with in every day life -- watching TV, seeing movies, reading books, or visiting amusement parks. Exploratory VR is interactively exploring a 3D environment solely through the monitor of a computer. Immersive VR is the classic stage of VR, where the user can fully interact with the artificial environment, is provided stimulation for all the senses, and have their actions directly affected the computer generated environment.”(*Brian Lingard. 1995*). However, high-quality, ubiquitous immersive virtual environments, needs high display resolution and brightness, no viewer encumbrance, and accurate head tracking.

There are two main types of virtual reality, immersive and non immersive. Immersive virtual reality involves the use of Head-Mounted Displays and other devices that allow you to actually immerse yourself inside the virtual world for a more realistic experience. Non-Immersive virtual reality is when just a standard computer or television monitor is used to display the virtual world.

2.2.1.2 Immersive Virtual Reality

“The very recent advancements in the computer 3D graphics technology, and in particular, the latest appearance of a powerful and affordable 3D graphics hardware, brings a fresh wave of interest to immersive VR applications that target rapidly growing educational and training needs of the modern information society.”(*Ponder,*