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**YAŞAR UNIVERSITY**

**FACULTY OF ENGINEERING**

**DEPARTMENT OF COMPUTER ENGINEERING**

**COMP4910 Senior Design Project 1, Fall 2018**

**Supervisor: Dr.Öğr.Üyesi Gizem Kayar**

POF: Performance Optimized Fluid System

**Final Report**

By:

İsmail Mekan-15070001048

Baran Budak-15070001012

Cihanser Çalışkan-16070001020

# PLAGIARISM STATEMENT

This report was written by the group members and in our own words, except for quotations from published and unpublished sources which are clearly indicated and acknowledged as such. We are conscious that the incorporation of material from other works or a paraphrase of such material without acknowledgement will be treated as plagiarism according to the University Regulations. The source of any picture, graph, map or other illustration is also indicated, as is the source, published or unpublished, of any material not resulting from our own experimentation, observation or specimen collecting.

**Project Group Members:**

|  |  |  |  |
| --- | --- | --- | --- |
| Name, Lastname | Student Number | Signature | Date |
| **İsmail Mekan** | **15070001048** |  |  |
| **Baran Budak** | **15070001012** |  |  |
| **Cihanser Çalışkan** | **16070001020** |  |  |

**Project Supervisors:**

|  |  |  |  |
| --- | --- | --- | --- |
| Name, Lastname | Department | Signature | Date |
| **Gizem Kayar** | **Computer Engineering** |  |  |

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# KEYWORDS

|  |  |
| --- | --- |
| **Term** | **Description** |
| Axis Aligned Bounding Box (AABB) | Bounding volume for a set of objects is a closed volume that completely contains the union of the objects in the set. |
| Cell | Axis aligned bounding box is divided into small identical cubes. |
| Colour field quantity | It is a functionthat calculates how each particle is affected by all of the other particles. |
| Gradient | The directional derivative of a scalar field gives a vector field directed towards where the increment is most, and its magnitude is equal to the greatest value of the change. |
| Grid | Series of vertical and horizontal lines that are used to subdivide AABB vertically and horizontally into cells in three-dimensional space. |
| Isosurface | An isosurface is a 3D surface representation of points with equal values in a 3D data distribution which is the 3D equivalent of a contour line. |
| Marching Cubes | Marching cubes is a computer graphics algorithm, published in the 1987 for extracting a polygonal mesh of an isosurface from a three-dimensional discrete scalar field. |
| NVIDIA Flex | NVIDIA Flex is a particle based simulation technique for real-time visual effects. |
| Polygonal Mesh | Polygon mesh is the collection of vertices, edges, and faces that make up a 3D object. |
| Unity 3D | Unity is a cross-platform game engine developed by Unity Technologies. Unity is used for developing video games and simulations for consoles and mobile devices. |
| Visual Studio | Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. |

# ABSTRACT

# ÖZET

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# LIST OF ACRONYMS/ABBREVIATIONS

|  |  |
| --- | --- |
| AABB | Bounding volume for a set of objects is a closed volume that completely contains the union of the objects in the set. |
| API | Acronym for Application Programming Interface. |
| CPU | Central Processing Unit. |
| GPU | Graphic Processing Unit. |
| OPENGL | Open Graphics Library is a cross-language, cross-platform application programming interface for rendering 2D and 3D vector graphics. |
| POF | An Acronym stands for performance optimized fluid system. |

# 1. INTRODUCTION

# 1.1. Description of the Problem

Calculation problem due to the number of particles in liquid simulations .

Time complexity and space complexity are over, because it is too much calculated particles. For this reason, cpu and gpu usage are wasted.

# 1.2. Project Goal

The algorithms used in the project are changed as a result of the researches and the calculation technique of the liquid particles is found to be more effective. Time complexity and space complexity are reduce for the system and making a more effective memory usage.

# 1.3. Project Output

# 1.4. Project Activities and Schedule

Gant Chart hazırlandı exelde.

# 2. DESIGN

# 2.1. High Level Design

# 2.2. Detailed Design

* This section will be completed in COMP 4920

# 2.3. Realistic Restrictions and Conditions in the Design

# 3. IMPLEMENTATION, TESTS and TEST DISCUSSIONS

# 3.1. Implementation of the Product

* This section will be completed in COMP 4920

# 3.2. Tests and Results of Tests

* This section will be completed in COMP 4920

# 4. CONCLUSIONS

# 4.1. Summary

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# 4.2. Cost Analysis(bu kısmıda bak)

**Employee working schedule**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Members** | **Daily/Hour** | **Weekly/Hours** | **Semester/Hours** | **Salary/Hour** | **TOTAL** | **Salary/Montly** |
| Member1 | 8 | 8\*5=40 | 40\*14=560 | 20 TL | 11.200 | 11.200/3.5=3.200 TL |
| Member2 | 8 | 8\*5=40 | 40\*14=560 | 20 TL | 11.200 | 11.200/3.5=3.200 TL |
| Member3 | 8 | 8\*5=40 | 40\*14=560 | 20 TL | 11.200 | 11.200/3.5=3.200 TL |

As shown in the table, 3 people work in our project.   
The working time is 5 days per week(weekday), 8 hours per day. this is a total period of 14 weeks.

Each employee earns 20 TL per hour.

Total employee budget= 11.200 \* 3 =33.600 TL

**Hardware and software price table**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Software/Hardware | Minimum Price | Average Price | Fxed Price | Total |
| Software |  |  | $30=30\*6=180TL | 180\*3=540 Tl |
| Hardware | 6.500 TL | 12.000 TL |  |  |

Unity Uflex is a asset, software purchased for our project. We used Uflex asset to search for the platform required for our project.

Since our project is simulation based, it is necessary to have GPU hardware.  
Required hardware: A D3D11 capable graphics card.

We use for this project geforce gtx 900 gpu.  
but if gpu is better, we will get more efficient output so we have reserved minimum and average cost.

Total cost= Total employee budget + Software cost + Hardware cost(min/average)

İf hardware cost will be minumum= 6.500 \* 3 Member=19.500

Total cost= 33.600 + 540 + 19.500 = 53.640 TL

İf hardware cost will be average= 12000\* 3 Member =36.000

Total cost =33.600 + 540 + 36.000= 70.140 TL

Since our project is research based, income is not expected.

# 4.3. Benefits of the Project

Our project can benefit in all areas where liquid simulation is available.

For Examples

* Animation movies
* Scientific work
* Health sector
* construction sector project design

# 4.4. Future Work

* Reduce time complexity and memory usage (space complexity).
* Although the computer hardware used today is multi-core, only a small part of the software we use is programmed in parallel. For this reason, these series of software can not use the hardware effectively and cause the user to waste time. Therefore, in order to be able to use hardware more efficiently, parallel codes will be written in the future.

# References

1. References to bibliographic sources, like professional books, textbooks, handbooks, patents, standards, technical reports, journal/conference papers, etc. that you have used in your project.
2. References to organizational design process procedure document(s), or a generic design process procedure document(s), if any (i.e. any documents you have used during your summer practice in a company and were also useful in your project.
3. References to organizational design product specification document(s), or a generic design product specification document(s), if any. Similar to (1).
4. Other references to additional documents, like other internal organizational documents, software project management documents, software design tool documents, etc, if any. Similar to (1).