Hacettepe University

Computer Science and Engineering Department

Name	: Tolgahan
Surname	: DİKMEN
Grade	: 3
ID Number	: 21327929
Subject of the Internship	: Software
Starting Date	: 12.06.2017
Ending Date	: 25.07.2017
Duration	: 6 Weeks / 30 Business Day
Company	: Vestel Defense Industry Co.
Address of the Company	: 1.Organize Sanayi Bölgesi Oğuz Cad. No: 7/B 06395 Sincan / ANKARA

CONTENTS

1. INTRODUCTION

1.1 The Aim of the Internship

Within the internship, theoretical knowledge that we have learned at school mix with the practical knowledge that we had done at the internship. To be a well-equipped engineer both theoretical and practical knowledge can be used in a same way. After the graduated from the collage and the get start in a business life the most important thing is work experiment with practical knowledge.

The crucial thing that I want receive in my internship that receiving all the information I can get, attending as many projects I can. Vestel Defense Industry which is big and corporate company provides me to learn how engineers works with each other and what they had done in their professional life. So I had a chance to see the business life in a way of engineers' responsibilities and works with coordination.

1.2 The Work Done At the Internship

I did the internship in the Vestel Defense Industry Co. I was the only computer engineer in the trainees. So I had worked alone during the internship. First day of the internship was a briefing about building; where is simulation room, where is the open office, where other engineers work in, which equipments are using, how process to test phase etc. After the informing, I got placed to work.

Starting to do something, I need to exploration about some algorithms and understand how they work. At the beginning of the second week I started coding according to responsible engineer of me. My aim was a write a program which needs to decide a point which consists of latitude and longitude is inside a specific area or not. The program has to use different algorithms for compare about run times and complexities of the algorithms. Also the project needs to suppose a graphical user interface and the program need to ability to work with .csv or .xlm files.

2. COMPANY PROFILE

2.1 Name of the Company

Vestel Defense Industry Co.

2.2 Address of the Company

1.Organize Sanayi Bölgesi Oğuz Caddesi No: 7/B 06395

Sincan / ANKARA

2.3 Contact Information

Tel   : +90 (312) 589 31 50

Fax   : +90 (312) 589 31 60

E-mail: vestel.savunma@vestel.com.tr

Web   : www.vestelsavunma.com.tr

2.4 Company Profile and History

Vestel Defense Industry Co, is the flagship ship of Zorlu Group, the Vestel Group of Companies, serving the defense industry sector. Vestel is one of the strongest players in Turkey and international markets in the sector. Vestel is one of the world's largest producers of technology and design development competence. Vestel Defense was established in 2003 with the subordination of this pioneering competence.

Vestel Defence offers a wide range of products and services in the Defense and Aerospace Industry, ranging from design and development to production, including Unmanned Aerial Vehicles, System Integration, Hydrogen and Fuel Cell Technologies.

In 2005, it was decided to develop a completely original UAV (Unmanned Aerial Vehicle) by investing in the unmanned air vehicle system with the Mini UAV Project initiated by the Undersecretariat of Defense Industries. Vestel Defense has a deep knowledge and experience on Unmanned Aerial Vehicles thanks to the work it has done on this day since 2005. Vestel Defense has the ability to design, produce and test the Unmanned Aerial Vehicle System in every level completely originally for the required tasks.

In the field of system integration activities, Vestel Defense Turkey's G-Class Combat Management System (G-GSYS) successfully came out of the

design and production tasks of hardware items in the Genesis project. It specializes in multifunctional console design and production in military standards, and with its experience and top-level engineering structure, it is able to provide console solutions with high reliability, easy maintenance and low operating cost by using COTS devices as much as possible.

In the field of Hydrogen and Fuel Oil (COP) technology, which has not begun mass production in the world, Vestel Defense has been the only company to develop solid oxide fuel cylinder for armoured vehicles by real research and development studies in the defense industry sector with its competent AR-GE personnel subordinate since 2004. At the same time, in cooperation with many universities and institutes that work on this field, many projects are being carried out to obtain products with AR-GE support.

Since the day Vestel Defense was founded, Zorlu Group has been specializing in developing or non-unique specific areas in the world, working with the national resources to develop original products in these fields with the support of Zorlu Group and to reduce the external dependency and to strengthen the power of the Turkish Defense Industry.

2.4.1 Karayel Tactical UAV System: Karayel Tactical UAV System is the first and only Tactical Unmanned Aerial Vehicle to NATO's 'Civil Aviation Flightability' Standard designed and manufactured according to STANAG-4671 for tactical discovery and surveillance. Thanks to the aluminium mesh on the aircraft composite structure, it has lightning protection. In case of confronted with the conditions of icing, 'Ice Depletion System' is used which detects this automatically and operates. With this feature, Karayel exhibits superior performance in extreme weather conditions, showing resistance to all kinds of weather conditions. It has the ability to detect and identify the target with the camera system it carries for air exploration and surveillance and to direct the laser-guided ammunitions with marker systems on it.

2.4.2 Electronic AR-GE: Vestel Defense has designed, developed and delivered to the customer Subsystem Interface (SIU) and Subsystem Adaptation (SAU) units developed to integrate the
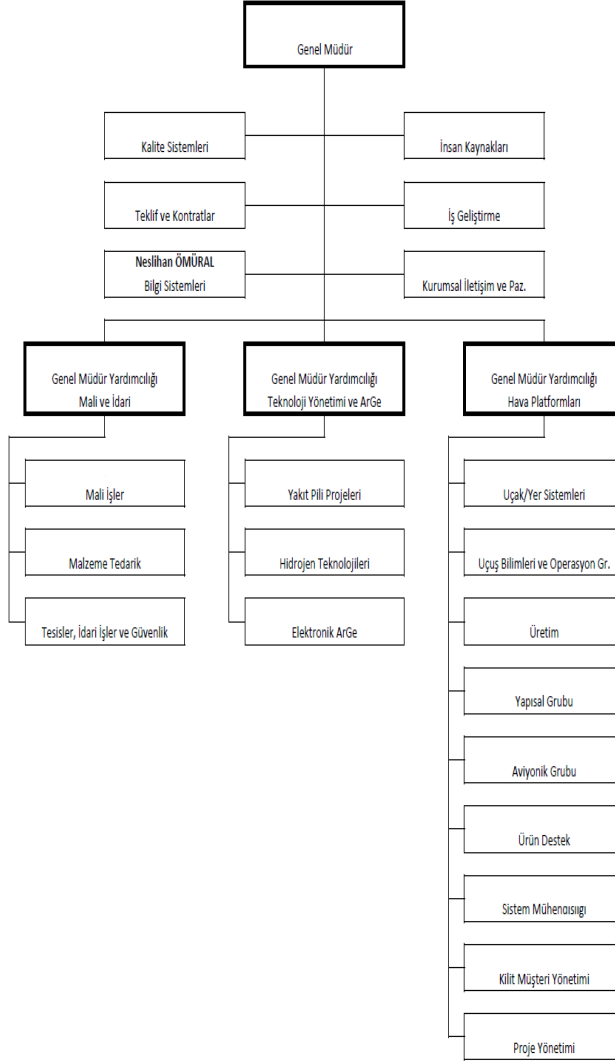
weapons and sensors into the floating platforms in real-time / semi-real-time on the system. It also provides solutions for the integration and automation of systems that enable efficient use of all common resources such as navigation, communications, power generation and distribution systems on floating platforms through the ship local area network.

2.4.3 Hydrogen and Fuel Pipe Technologies: Vestel Defense Industry Co., has gained important know-how about developing Solid Oxide Fuel Pump (KOYP) cells and stak. Vestel Defense has produced many patent and utility models besides national and international publications on KOYP membrane production, KOYP cell and stak design, sodium borohydride (SBH) hydrogen production, PEM fuel cells.

2.5 Company Management

Genel Müdür

Kalite Sistemleri	İnsan Kaynakları
Teklif ve Kontratlar	İş Geliştirme
Neslihan ÖMÜRAL Bilgi Sistemleri	Kurumsal İletişim ve Paz.

Genel Müdür Yardımcılığı Mali ve İdari

- Mali İşler
- Malzeme Tedarik
- Tesisler, İdari İşler ve Güvenlik

Genel Müdür Yardımcılığı Teknoloji Yönetimi ve ArGe

- Yakıt Pili Projeleri
- Hidrojen Teknolojileri
- Elektronik ArGe

Genel Müdür Yardımcılığı Hava Platformları

- Uçak/Yer Sistemleri
- Uçuş Bilimleri ve Operasyon Gr.
- Üretim
- Yapısal Grubu
- Aviyonik Grubu
- Ürün Destek
- Sistem Mühendisliği
- Kilit Müşteri Yönetimi
- Proje Yönetimi

3. INTERNSHIP PROCESS

First days of the internship, I had a research on ray-casting algorithm to understand the aim of my project. After a few researches I have gotten the basic of the project. I have been required to improve a project which can use ray-casting algorithm to calculating position of a point relative to a polygon. Testing whether a point is inside a polygon is the main of the project. C++ was used as programming language.

The point is similar to point of a plane. The point contains latitude and longitude. The point will be given by the user.

The polygon refers to a certain region. There are two different types of polygons: convex and non-convex. In my project the point can be one of them. If a number of points are to be tested against a polygon, it may be worthwhile determining whether the polygon is convex at the start and so be able to use a faster test. Information of the polygon will be in the program. I need to calculate location of the point according to the polygon. Then result will be a Boolean value like 'Inside' or 'Outside'.

At first I have used ray-casting algorithm to solving the problem. After the ray-casting algorithm has been successfully run, different algorithms have been added to the project. As a result, three different algorithms were used. They are;

- Ray-Casting Algorithm
- Sum-Angle Algorithm
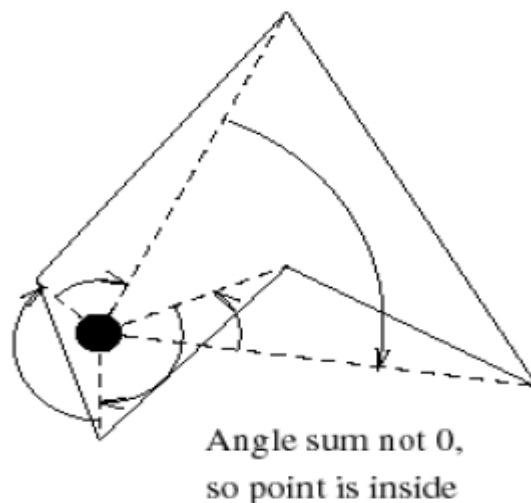- Badouel Triangle Algorithm

3.1 Ray-Casting Algorithm

A point is inside a polygon if, for any ray from this point, there is an odd number of crossings of the ray with the polygon's edges. This definition means that some areas which are enclosed by a polygon are not considered inside. The center pentagonal area inside a star is classified as outside because any ray from this area will always intersect an even number of edges.

Three crossings, so
point is inside
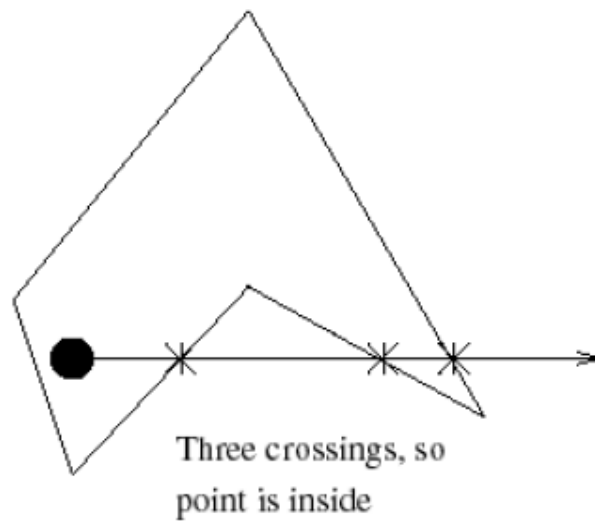
3.2 Sum-Angle Algorithm

The worst algorithm in the world for testing points is the angle summation method. It's simple to describe: sum the signed angles formed at the point by each edge's endpoints. If the sum is near zero, the point is outside; if not, it's inside. In fairness, the angle algorithm can be sped up in various ways, but it will still always be faster to use any other algorithms.

Angle sum not 0,
so point is inside

3.3 Badouel Triangle Algorithm

Didier Badouel presents a method of testing points against convex polygons. The polygon is treated as a fan of triangles emanating from one vertex and the point is tested against each triangle by computing its

barycentric coordinates. This test can also be used for non-convex polygons by keeping a count of the number of triangles which overlap the point; if odd, the point is inside the polygon. Unlike the convex test, where an intersection means that the test is done, all the triangles must be tested against the point for the non-convex test. Also, for the non-convex test there may be multiple barycentric coordinates for a given point, since triangles can overlap.

Inside odd number of
triangles, so point is inside
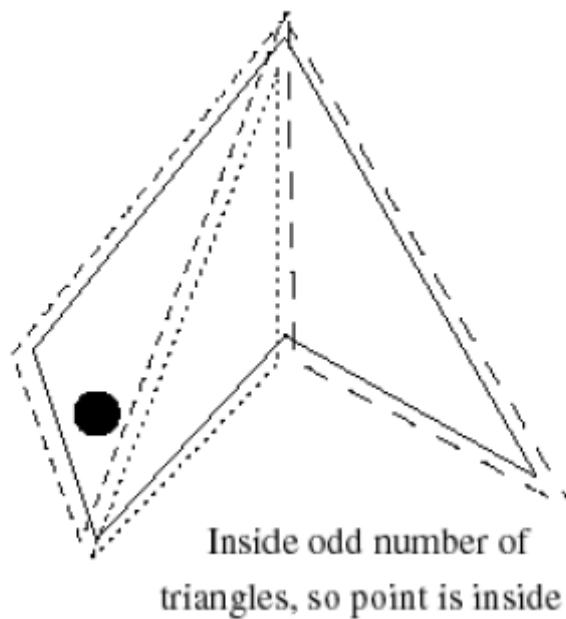
After running the different algorithms and comparing them, different details of the program have been added. I added the reading of the .cvs files which is based on the .xml files to the program. So the polygon can be set more easily to the program. Below are a few screenshots of the program.

After 'Select' button is selected.
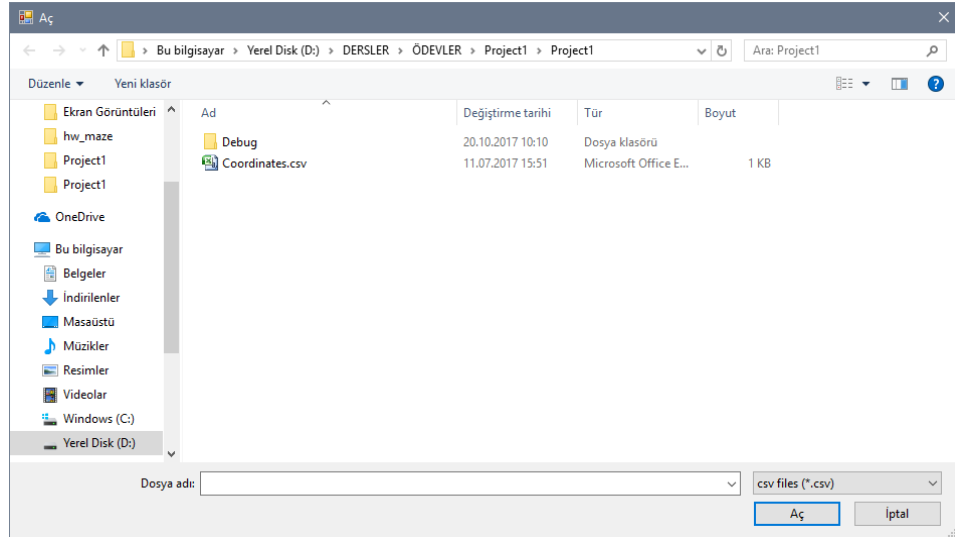
Application Test

Enter Latitude and Longitude

Latitude   15
Longitude   14
          Calculate

Result   Inside

Execution Time   33782508

Select CSV File   Select

Coordinates.csv selected.

Algorithms
  ● Ray Casting Algorithm
  ○ Sum-Angle Algorithm
  ○ Badouel Triangle Algorithm

Application Test

Enter Latitude and Longitude

Latitude   20
Longitude   30
          Calculate

Result   Outside

Execution Time   28979576

Select CSV File   Select

Coordinates.csv selected.

Algorithms
  ○ Ray Casting Algorithm
  ○ Sum-Angle Algorithm
  ● Badouel Triangle Algorithm

4. EVALUATION

Throughout the internship, I have understood how I can come from above the difficulties that can be encountered in working life. I have learned how is the division of work done, how to find solutions to the problems in a coordinated way, how team work is done. I have developed the ability to build project bases, design the project, and evaluate a project in terms of time performance. I have refreshed the theoretical knowledge what I learned in college practically. I have felt that I have developed my own working logic of the institutions and work in accordance with this logic and got one step closer to my business life.

5. REFERENCES

- http://www.vestelsavunma.com/
- https://stackoverflow.com/questions/217578/how-can-i-determine-whether-a-2d-point-is-within-a-polygon
- https://en.wikipedia.org/wiki/Point_in_polygon
- http://alienryderflex.com/polygon/
- http://erich.realtimerendering.com/ptinpoly/
- http://www.cplusplus.com/
- (MacMartin 1992) MacMartin, Stuart, et al, "Fastest Point in Polygon Test," Ray Tracing News 5(3), 1992.
- (Green 1993) Green, Chris, "Simple, Fast Triangle Intersection," Ray Tracing News 6(1), 1993.
- (Worley 1993b) Worley, Steve and Haines, Eric, "Triangle Intersection Revisited," Ray Tracing News 6(2), 1993.