UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN AND ANALYSIS OF OBJECT LOCATOR IN GPS TRILATERATION SYSTEM

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronics Engineering Technology (Telecommunications) with Honours.

by

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electronics Engineering Technology (Telecommunications) with Honours. The member of the supervisory is as follow:

.....

(Project Supervisor)

ABSTRAK

Projek ini mencadangkan reka bentuk dan analisis Sistem Kedudukan Global (GPS), kemudian membandingkan hasil daripada pengiraan dan simulasi. Prinsip asas adalah dengan membuat kajian pada formula yang boleh digunakan dalam projek ini. Apabila formula telah dikumpulkan, proses mereka bentuk GUI dirancang dengan menggunakan perisian MATLAB. Projek ini memberi tumpuan terutamanya kepada perbezaan parameter sistem trilateration di antara pengiraan dan simulasi. Pengiraan yang akan diberi perhatian ialah ketepatan sistem daripada keputusan pengiraan dan simulasi dan prestasi sistem. Hasil projek adalah untuk mengatasi kekurangan pengetahuan mengenai GPS di UTeM.

ABSTRACT

This project proposes the design and analysis of Global Positioning System (GPS), then compares the result of calculation and simulation. The basic principle is to research on the formulas that can be used in this project. Once the formulas are gathered, the designing of GUI is planned by using MATLAB software. The project is mainly focus on the difference of trilateration system's parameter between calculation and simulation. The calculation that will be considered are the accuracy of the system from the calculation and simulation results and the performance of the system. The project outcome is to overcome the lack of knowledge about GPS object locator in UTeM.

DEDICATION

This thesis is dedicated to my dad, who showed me that the best sort of information to have is what is found out for its own purpose. It is likewise dedicated to my mom, who showed me that even the biggest assignment can be refined on the off chance that it is done with extra special care. They likewise helped me fiscally and bolstered all through completing this project report.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

DoD	-	Department of Defense
ECEF	-	Earth-Centered, Earth-Fixed
FOC	-	Full operational capability
GPS	-	Global Positioning System
GUI	-	Graphical User Interface
IOC	-	Initial Operation Capability
MCS	-	Master Control Station
OCS	-	Operational Control Segment
RTK	-	Real-Time Kinematic

CHAPTER 1
INTRODUCTION

1.0 Introduction

This chapter gives a brief on the project background, problem statement, objectives, scope and limitation of the project. Understanding on the overall description of project can be gain through this chapter.

1.1 Project Background

In GPS, finding the location of an object using 3 dimension locator is known as trilateration system. It will measure the different coordinate of a target as range, elevation, azimuth angle and Doppler shift frequency to determine the target path and to predict its future position. Three satellites are needed to detect the latitude and longitude, and one additional satellite to track the altitude as well. This project will analyse the trilateration system especially in GPS system from the theoretical view, design and measurement aspects. The measurement will include all the parameters that are related. Comparison to other system also will be made to find its advantage and disadvantage. The tasks are literature studies, design, animation, simulate and discussion.

1.2 Problem Statement

Considering FTK itself, many students and even lecturers do not know how GPS works. The lack of knowledge of locator by using GPS has been a major problem since it may be a mostly used item in the coming future. Moreover, the technology of GPS locator is still not widely used. Many navigation applications such as Google Map and Waze require internet to operate. We, as students face many issues regarding personal financial problems. Due to that factor, most of the students doesn't subscribe to internet data plans. Many telcos providing data plans with higher rate which students cannot afford to buy one. This is why the GPS technology is still not widely used among students. Other than that, the GPS accuracy is still low. Sometimes, when we used to navigate to a certain location, the GPS tends to lead to a different location which may located near to the desired location. This proves that the GPS sometimes may provide wrong positioning. To have a fully operational GPS system, a GPS interface need to be utilized.

1.3 Objective

The objectives of this project are:

1. To understand the working principle of trilateration system as well as the GPS system.
2. To design object locator system using Graphical User Interface (GUI) in MATLAB software which determines the location of an object.
3. To analyse the results found by comparing the calculation results with the simulation outputs using comparison table.

1.4 Scope

This project research will focus primarily on the functions of a GPS as well as the trilateration system. This system will be created using the MATLAB software which can be useful in producing the appropriate GUI. Other aspects such as the production of project (hardware) and marketing of this features will not be covered in this project.

There are several scopes considered in this project research that can be categorized into four main element processes. These elements can help to obtain the understanding about the whole project research in order to develop the project. The elements are:

a) Animation.

b) Calculation.

c) Simulation.

Lastly, the task will be continued on writing the project report.

1.5 Structure of Report

This thesis contains of five chapters. Chapter one describes about introduction, problem statement of the project, objective of the project that describes the reason for developing this project, scope of the project and the structure of report.

Chapter two covers the literature review about the Design and Analysis of Object Locator in GPS Trilateration System. This chapter reviews on previous research, references and journals about related topics to this project. Various methods and approaches that are related to the project are discussed and reviewed.

Chapter three explains the methodology of this project research. This project methodology includes the designing of flowchart and Gantt chart. Other reviews are also included based on the information that are gathered from all the sources such as journal, research and other theory that are related. All the calculations are also added to this chapter.

Chapter four explains the results, analysis and discussion of this project. This project used all the research that currently being done to get all the results. The analysis from the information is very important to produce the data that is needed and related to the topic of this project. The flow chart of the project and the diagram are used to explain in this chapter.

Chapter five is about the conclusion for the whole research and the proposed recommendation for the future progress for the project.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

Literature review will be continuously carried to study past and current research works. Many applications and related studies are done by the navigation authorities and also researchers related to the topic. Some very important data have to be studied, reviewed, determined and will be applied for the project.

2.1 Global Positioning System (GPS)

The Global Positioning System (GPS) is a satellite-based course structure that was made by the U.S. Division of Defense (DoD) in the mid-1970s as the forefront substitution to the Transit structure. At to begin with, GPS was delivered as a military system to fulfill U.S. military needs. In any case, it was later made open to customary subjects, and is right now a twofold use structure that can be gotten to by both military and non-military staff customers.

GPS gives predictable arranging and timing information wherever on the planet under any atmosphere conditions. Since GPS is a confined broadening (standoffish) system, it serves countless and furthermore being used for security reasons. That is, customers can simply get the satellite signs (Ahmed El-Rabbany, 2006).

Global Positioning System (GPS) is setup to show your right position on the Earth at whatever time, wherever, and in any atmosphere. GPS satellites, 24 taking all things together, hover over the Earth at 11,000 nautical miles from the surface. Ground stations discovered general always screen them. The satellites transmit signals that can

be perceived by anyone with a GPS authority. There are various applications for the stand-out navigational structure. This system can be used for plane and vehicle course, rocket bearing, and geographical mapping. Our essential fixation is to execute the Global Positioning System Network reasonably that licenses investigating, arranging, and following in an indoor space (Michael Wright, Dion Stallings and Dr. Derrek Dunn, 2003).

2.1.1 Overview of GPS

GPS comprises, ostensibly, of a heavenly body of 24 operational satellites. This star grouping was finished in July 1993, which was known as the underlying operation capacity (IOC). The authority IOC declaration, notwithstanding, was made on December 8, 1993. To guarantee persistent overall scope, GPS satellites are masterminded with the goal that four satellites are put in every six orbital planes as shown in Figure 2.1. With this heavenly body geometry, four to ten GPS satellites will be obvious anyplace on the planet, if a height veil of 10 degrees is considered. As talked about later, just four satellites are expected to give the situating, or area, data.

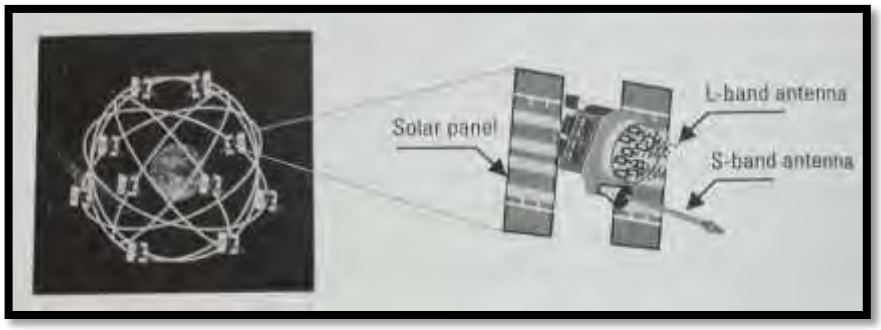

Figure 2.1 GPS constellation

GPS satellite circles are almost roundabout (a curved shape with a most extreme erraticism of around 0.01), with a slant of around 55 degree to the equator. The semimajor axis of a GPS circle is around 26,560 km (i.e., proportional to a satellite height of around 20,200 km over the Earth's surface).

The comparing GPS orbital period is roughly 12 sidereal hours (~11 hours, 58 minutes). The GPS framework was authoritatively announced to have accomplish full operational capability (FOC) on July 17, 1995, guaranteeing the accessibility of no less than 24 operational, nonexperimental, GPS satellites. Truth be told, since GPS accomplished its FOC, the quantity of satellites in the GPS group of stars has dependably been more than 24 operational satellites.

2.1.2 GPS Segments

GPS comprises of three sections: space, control, and client as shown in Figure 2.2. The space portion comprises of the 24-satellite group of stars presented in the past area. Every GPS satellite transmits a signal, which has various parts: two sine waves (otherwise called bearer frequencies), two advanced codes (or more for modernized GPS satellites), and a route message. The codes and the route message are added to the transporters as paired biphase tweaks. The transporters and the codes are utilized mostly to decide the separation from the client's collector to the GPS satellites. The route message contains, alongside other data, the directions (the area) of the satellites as a component of time. The transmitted signs are controlled by exceedingly precise nuclear timekeepers on load up the satellites.

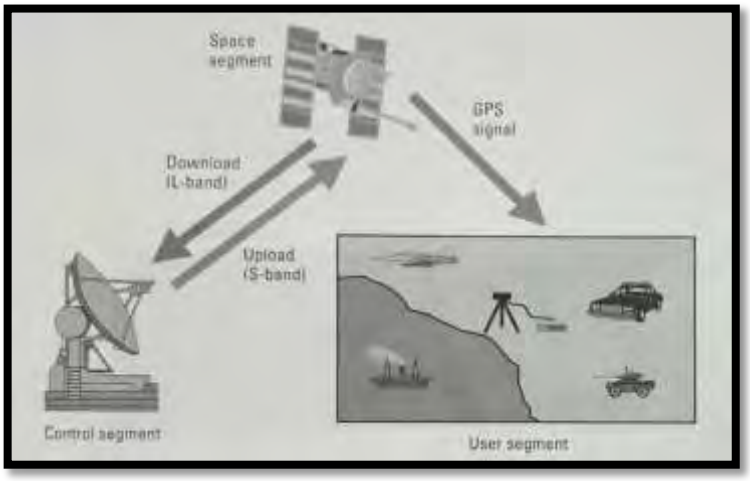

Figure 2.2 GPS segments

The control fragment of the GPS framework comprises of an overall system of following stations, with a master control station (MCS) situated in the United States at Schriever Air Force Base close Colorado Springs, Colorado. The essential assignment of the operational control section (OCS) is to track the GPS satellites utilizing various checking stations, so as to decide and anticipate satellite areas, framework respectability, conduct of the satellite nuclear timekeepers, climatic information, the satellite chronological registry, and different contemplations. This data is then stuffed and transferred to the GPS satellites by the ground reception apparatuses through the S-band connect.

The client fragment incorporates all military and regular citizen clients. With a GPS collector associated with a GPS radio wire, a client can get the GPS signals, which can be utilized to decide his or her position anyplace on the planet. GPS is as of now accessible to all clients worldwide at no immediate charge.

2.1.3 Basic GPS Concept

The position of a specific point in space can be found from separation measured starting here to some known positions in space. Let us use some examples to decide this location. In Figure 2.3, the client position is on the x-axis; this is a one-dimensional case. On the off chance that the satellite position S_1 and the separation to the satellite x_1 are both known, the client position can be at two spots, either to the left or right of S_1. Keeping in mind the end goal to decide the client position, the separation to another to another satellite with known position must be measured. In this figure, the places of S_2 and x_2 extraordinarily decide the client position U.

Figure 2.3 One-dimensional user position

Figure 2.4 demonstrates a two-dimensional case. With a specific end goal to decide the client position, three satellites and three separations are required. The hint of an indicator with consistent separation a settled point is a hover in the two-dimensional case. Two satellites and two separations give tow conceivable arrangements since two circles meet at two focuses. A third circle is expected to exceptionally decide the client position.

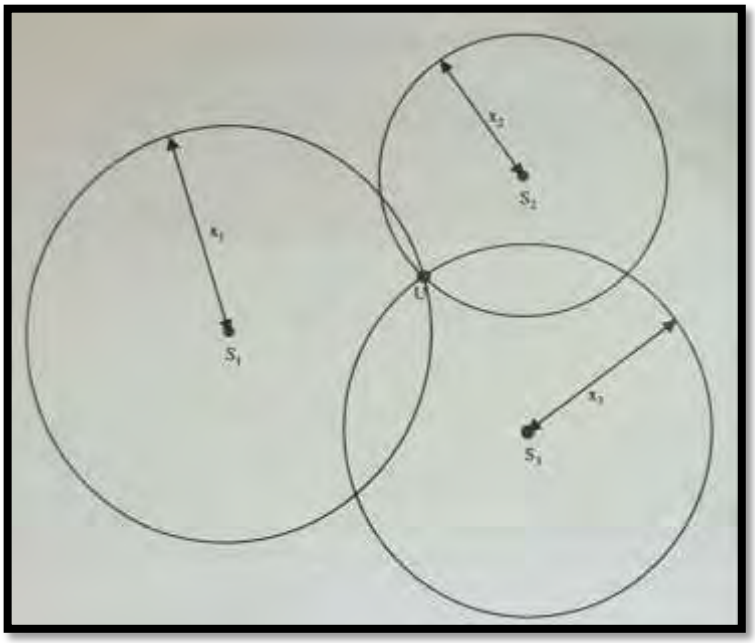

Figure 2.4 Two-dimensional user position

For comparable reasons one may choose that in three-dimensional case four satellites and four separations are required. The equivalent separation follow to a settled point is a circle in a three-dimensional case. Two circles converge to make a circle. This circle converges another circle to create two focuses. With a specific end goal to figure out which point is the client position, one more satellite is required.

In GPS the position of the satellite is known from the ephemeris information transmitted by the satellite. One can quantify the separation from the beneficiary to the satellite. Accordingly, the position of the collector can be resolved.

In the above examination, the separation measured from the client to the satellite is thought to be exceptionally exact and there is no predisposition

mistake. Be that as it may, the separation measured between the recipient and the satellite has a consistent obscure predisposition, in light of the fact that the client clock more often than not is unique in relation to the GPS clock. So as to determine this predisposition mistake one more satellite is required. Accordingly, keeping in mind the end goal to discover the client position five satellites are required.

In the event that one uses four satellites and the deliberate separation with inclination blunder to gauge a client position, two conceivable arrangements can be acquired. Hypothetically, one can't decide the client position. Be that as it may, one of the arrangements is shut to the world's surface and the other one is in space. Since the client position is generally near the surface of the earth, it can be particularly decided. Consequently, the general explanation is that four satellites can be utilized to decide a client position, despite the fact that the separation measured has a predisposition blunder.

The underlying position is regularly chosen at the focal point of the earth. The emphasis strategy will unite on the right arrangement as opposed to the one in space. In the accompanying talk four satellites are viewed as the base number required in finding the client position (James Bao and Yen Tsui, 2005).

2.1.4 Why Use GPS?

GPS has altered many fields (e.g., studying and route) since its initial phases of advancement. Despite the fact that GPS was initially composed as a military framework, its common applications have developed much speedier. With respect to the future, it is said that the quantity of GPS applications will be restricted just by one's creative ability.

On the studying side, GPS has supplanted customary techniques in numerous applications. GPS situating has been observed to be a financially savvy prepare, in which no less than a 50 percent cost decrease can be gotten at whatever point it is conceivable to utilize the supposed constant kinematic (RTK) GPS, as contrasted and traditional strategies. As far as profitability and