# DEVELOPMENT OF BLUETOOTH GPS RECEIVER

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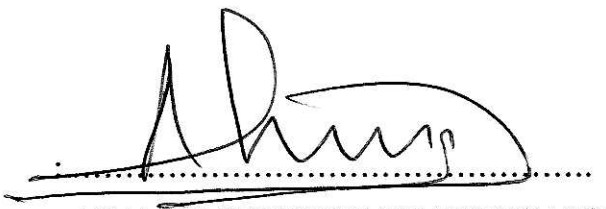
Signature : 

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I dedicate this book to my family members who have supported me and helped me to realize my dreams. Secondly, heartfelt thanks to all my UTeM lecturers especially Miss Nurmala Irdawaty whose tremendous guidance and support kept me going throughout my final year project. Last but not least, I would like to thank my friends who directly or indirectly involved making this project a success.

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# ABSTRACT

This project is about Development of Bluetooth GPS Receiver which consists developing the software to be integrated with the Bluetooth Global Positioning System (GPS) receiver for computation purposes where the software will display our position on earth. The objective of this project is to design and build software that will be able to read data via serial or Bluetooth connection from the GPS Receiver. This project consists of two parts which are designing of the software and the second part is the communication between the receiver, the satellites and the software. The expected outcome of the project is expected to be GPS software which is installed into Personal Digital Assistant (PDA) that reads data via serial or Bluetooth connection and can determine our position on earth. This report is summarization of my final year project which is Development of Bluetooth GPS Receiver. The content of the report covers about the introduction of the project, problem statements, project objective, methodology, project progress, expected result and conclusion of the project. This report also covers the general knowledge such as the theory of Global Positioning System (GPS), Bluetooth and also theories about the coding used to design the software.

# ABSTRAK

Projek ini bertujuan untuk membina sebuah sistem Bluetooth GPS Receiver dimana sistem ini boleh menentukan kedudukan pengguna di atas muka bumi ini. Projek ini mengandungi dua bahagian iaitu pembinaan perisian GPS yang boleh memproses data dari penerima GPS dan bahagian ke dua ialah proses penghubungan antara perisian GPS dan juga penerima GPS tersebut. Jangkaan hasil projek ini ialah terhasilnya satu perisian GPS dipasang dalam PDA dan boleh memproses data dari penerima GPS melalui kabel sesiri atau Bluetooth dan mempamerkan kedudukan pengguna dalam bentuk latitude dan longitude. Laporan ini adalah rumusan projek tahun akhir dimana ianya mengandungi pengenalan projek, penyataan masalah, objektif projek, kaedah yang digunakaan, perjalanan projek, hasil projek dan juga kesimpulan projek. Projek ini juga mengandungi teori-teori berkaitan GPS, Bluetooth dan beberapa perkara lain.

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# LIST OF ABBREVIATIONS

GPS - Global Positioning System

PDA - Personal Digital Assistant

PCB - Printed Circuit Board

# CHAPTER I

## INTRODUCTION

Trying to figure out where we are and where we are going is probably one of man's oldest pastimes. Navigation and positioning are crucial to so many activities and yet the process has always been quite cumbersome. Over the years all kinds of technologies have tried to simplify the task but every one has had some disadvantage. That is until early 1990's where the U.S Military Department introduces Global Positioning System (GPS) which they say can determine exact position on earth. The Global Positioning System is a worldwide radio-navigation system formed from a constellation of 24 satellites and their ground stations. GPS uses these satellites as reference points to calculate positions accurate to a matter of meters by using specialized receivers. GPS receivers have been miniaturized to just a few integrated circuits and so are becoming very economical and that makes the technology accessible to virtually everyone. These days GPS is finding its way into cars, boats, planes, construction equipment, movie making gear, farm machinery, even laptop computers. Cars come installed with GPS navigation systems for negotiating city streets and highways. Cell phones are even starting to show up with tiny GPS receivers embedded inside. Soon GPS will become almost as basic as the telephone.

## 1.1 PROJECT OBJECTIVES

The purpose of this project is to design and implement software that can read data from Global Positioning System (GPS) Receiver. The data that is read by the software is then used for computation purposes in order to determine our position.

Other than that, the project is also aimed at studying the connectivity type between the GPS receiver and the software. There are several types of connectivity that can be used to connect the GPS Receiver to the software such as serial, USB and Bluetooth. Next is to study the data type that contains in the information gathered from the receiver because there are several data such as the latitude, longitude, time and speed. User can extract these data by using specialize software in order to compute their position.

Last but not least, to study how the GPS system works and the circuitry involved in the receiver.

## 1.2 SCOPE OF WORK

GPS software is a program that gathers data from GPS receiver through certain connection (serial, USB or Bluetooth) and computes user's position and speed (if they are moving). The scope of this project is to design, develop and implement the GPS software. In this project, I use a GPS receiver that is already available on the market. Therefore, this project only focuses on designing and programming of the software and secondly, communication between the software and the receiver where data transferring from satellites to software via serial, USB or Bluetooth for computation occurs.

## 1.3 PROBLEM STATEMENT

Nowadays, we may have read upon people getting lost in jungle while trekking or conducting research in the jungle. However, this problem can be overcome with the use of Bluetooth GPS receiver because this receiver can interact with a PDA that is installed with the appropriate software to determine our position and the path that we take while in the jungle. Even when we are lost from our path, the receiver along with the installed software will be able to show our exact position and how far we are from the actual path. This will enable user to get back to their base or starting point safely.

Other than that, we may also hear about people unable to navigate through a new town that is unfamiliar to them or we may even face this situation before. This problem will never occur again with the help of Bluetooth GPS Receiver along with PDA pre-installed with the appropriate GPS software, the system will enable user to get to their destination without any glitch because the system can locate our current position and we can view the path to be taken. It is also the same for ambulance, fire brigade or police. They can get to their destination, in case of emergencies, much faster.

GPS Software can also be used in on-air navigational purposes such as for airplanes and helicopters. On the other hand, farmers are also starting to use GPS in their agriculture business to conduct precision farming operations such as chemical and fertilizer application. GPS also provides location information that enables farmers to plow, harvest, map their fields, and mark areas of disease or weed infestation at any time of day or night.

## 1.4 METHODOLOGY

Methodology used and applied to build up this project consists of several ways stated as below:

### 1.4.1 Literature Reviews:

1.4.1.1 Theories on GPS system
1.4.1.2 Theories on GPS receiver
1.4.1.3 Theories on GPS software
1.4.1.4 Theories of how the GPS system works

### 1.4.2 Project Proposal:

1.4.2.1 Information of project including synopsis, objectives, scope, methodology and expected result.

### 1.4.3 Software Design:

1.4.3.1 Study and design a GPS software

### 1.4.4 Testing and Measurement / Result and analysis

1.4.4.1 Debug and test the software
1.4.4.2 Analyze the data from the receiver
1.4.4.3 Test the connectivity

### 1.4.5 Troubleshooting

1.4.5.1 To justify the error if the software have bugs.

## 1.5 THESIS OUTLINE

This thesis consists of five chapters; Introduction, literature review, methodology, result and discussion, and finally the conclusion. I had discussed about project objectives, scope of work, problem statement and methodology in chapter 1 which is introduction chapter.

In chapter 2, I will discuss the literature review of my project concerning my findings about Global Positioning System and I will discuss more on how I am going to complete this project in chapter 3.

Chapter 4 shows my results and my findings which is basically about my GPS software and the analysis of data and connectivity. Lastly, I conclude the entire project and have some suggestions or future plans for this project in chapter 5.

# CHAPTER II

# LITERATURE REVIEW

## 2.1 BRIEF HISTORY OF GLOBAL POSITIONING SYSTEM

Military, government, and civilian users all over the world rely on Global Positioning System (GPS) for navigation and location positioning but radio signals have been used for navigation purposes since the 1920s. Long Range Aid to Navigation (LORAN), a position-finding system that measured the time difference of arriving radio signals was developed during World War II. [1] The first step to GPS came way back in 1957 when the Russians launched *Sputnik,* the first satellite to orbit the Earth. Sputnik used a radio transmitter to broadcast telemetry information. [2] Scientists at the Johns Hopkins Applied Physics Lab discovered that the Doppler shift phenomenon applied to the spacecraft and almost unwittingly struck gold. A down-to-earth, painless example of the Doppler shift principle is when user stands on a sidewalk and a police car speeds by in hot pursuit of a stolen motorcycle. The pitch of the police siren increases as the car approaches user and then drops sharply as it moves away. American scientists figured out that if they knew the satellite's precise orbital position, they could accurately locate their exact position on Earth by listening to the pinging sounds and measuring the satellite's radio signal Doppler shift. By the 1960s, several rudimentary satellite positioning systems existed. The U.S. Army, Navy and Air Force were all working on independent versions

of radio navigation systems that could provide accurate positioning and all weather, 24-hour coverage. In 1973, the Air Force was selected as the lead organization to consolidate all the military satellite navigation efforts into a single program. [2] This evolved into the Navigation Satellite Timing and Ranging (NAVSTAR) GPS which is the official name for the United States' GPS program. [2] The U.S. military wasn't just interested in GPS for navigation. A satellite location system can be used for weapons system targeting. Smart weapons such as the Tomahawk cruise missile use GPS in their precision guidance systems. [1] GPS, combined with contour-matching radar and digital image-matching optics, makes a Tomahawk an extremely accurate weapon. The possibility of an enemy using GPS against the United States is one reason why civilian GPS receivers are less accurate than their restricted use military counterparts. The first NAVSTAR satellite was launched in 1974 to test the concept. By the mid-1980s, more satellites were put in orbit to make the system functional. In 1994, the planned full constellation of 24 satellites was in place. Soon, the military declared the system completely operational. The program has been wildly successful and is still funded through the U.S. Department of Defense.

## 2.2 WHAT IS GLOBAL POSITIONING SYSTEM?

The GPS is a U.S owned utility that provides users with positioning, navigation and timing services. [4] This system consists of three segments: the space segment, the control segment and the user segment. The U.S. Air Force develops, maintains and operates the space and control segments. The space segment consists of a nominal constellation of 24 operating satellites that transmit one-way signals that give the current GPS satellite position and time. The control segment consists of worldwide monitor and control stations that maintain the satellites in their proper orbits through occasional command maneuvers and adjust the satellite clocks. It tracks the GPS satellites, uploads updated navigational data and maintains health and status of the satellite constellation. The user segment consists of the GPS receiver equipment which receives the signals from the GPS satellites and uses the transmitted information to calculate the user's three-dimensional position and time. GPS satellites provide service to civilian and military users. The civilian service is freely available to all users on a continuous, worldwide

basis. The military service is available to U.S. and allied armed forces as well as approved Government agencies.

### 2.2.1 SPACE SEGMENT

The space segment includes the satellites and the Delta rockets that launch the satellites from Cape Canaveral, in Florida. GPS satellites fly in circular orbits at an altitude of 10,900 nautical miles (20,200 km) and with a period of 12 hours. [1] The orbits tilted to the earth's equator by 55 degrees to ensure coverage of Polar Regions. [1] Powered by solar cells, the satellites continuously orient themselves to point their solar panels toward the sun and their antenna toward the earth. Each of the 24 satellites, positioned in 6 orbital planes, circles the earth twice a day. [1]

The satellites are composed of:

2.2.1.1 Solar Panels: Each satellite is equipped with solar array panels. These panels capture energy from the sun which provides power for the satellite throughout its life.

2.2.1.2 External components such as antennas. The exterior of the GPS satellite has a variety of antennas. The signals generated by the radio transmitter are sent to GPS receivers via the L-band antennas. Another component is the radio transmitter which generates the signal. Each of the 24 satellites transmits its own unique code in the signal.

2.2.1.3 Internal components are such as atomic clocks and radio transmitters. Each satellite contains four atomic clocks. These clocks are accurate to at least a billionth of a second or a nanosecond.

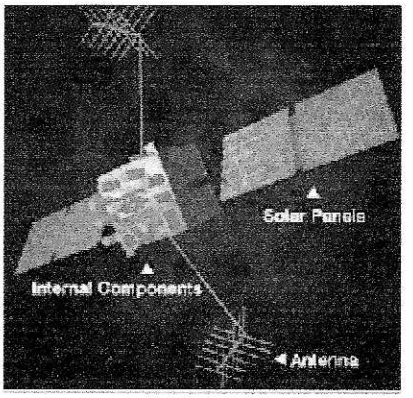


Figure 2.1: Components of Satellites

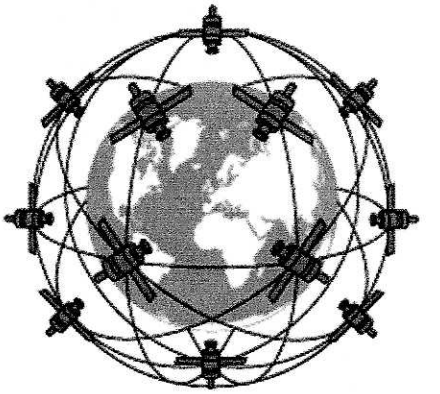

Figure 2.2: Satellites and their orbits

### 2.2.2 CONTROL SEGMENT

The Control Segment of GPS consists of:

2.2.2.1 Master Control Station: The master control station, located at Falcon Air Force Base in Colorado Springs, Colorado, is responsible for overall management of the remote monitoring and transmission sites. [3] GPS ephemeris being a tabulation of computed positions, velocities and derived right ascension and declination of GPS satellites at specific times, replace "position" with "ephemeris" because the Master Control Station computes not only position but also velocity, right ascension and declination parameters for eventual upload to GPS satellites.

2.2.2.2 Monitor Stations: Six monitor stations are located at Falcon Air Force Base in Colorado, Cape Canaveral, Florida, Hawaii, Ascension Island in the Atlantic Ocean, Diego Garcia Atoll in the Indian Ocean, and Kwajalein Island in the South Pacific Ocean. [4] Each of the monitor stations checks the exact altitude, position, speed and overall health of the orbiting satellites. The control segment uses measurements collected by the monitor stations to predict the behavior of each satellite's orbit and clock. The prediction data is up-linked, or transmitted, to the satellites for transmission back to the users. The control segment also ensures that the GPS satellite orbits and clocks remain within acceptable limits. A station can