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SPACE STATION TRACKING SYSTEM

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This Report Is Submitted In Partial Fulfillment of Requirement for the Bachelor Degree of Electronic Engineering (Computer Electronic)

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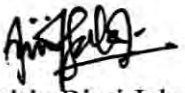
APRIL 2006

DECLARATION

"I, hereby declare that this thesis entitle, Space Station Tracking System is a result of my own research idea except for works that have been sited clearly in the references"

Signature : 

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Special dedication to my loving parents, En Jalani Abu Shah and Pn Mahanum Md Saleh, all my siblings, my kindhearted supervisor Mr Azmi Awang Md Isa and special thank to my dearest friends.

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ABSTRACT

The movement of the satellite, spacecraft or space station is in orbiting the earth especially in Low earth orbit (LEO). The location of the satellite, spacecraft or space station can be determined based on latitude and longitude. The spacecraft is modeled as a rigid body with N as symmetric wheels controlled by axial torques and the kinematics are represented by Modified Rodriquez Parameters. The trajectory denoted the reference trajectory, is one generated by a virtual spacecraft that is identical to the actual spacecraft. Nowadays, there are two space station in the low earth orbit which is International Space Station (ISS) and Mir (Russia). This project develops software that can be used to calculate the current and future positions of the International Space Station. Also, the software that developed can make pass predictions and track the real-time location of the ISS in the earth orbit.

ABSTRAK

Pergerakan satelit, kapal angkasa, ataupun stesen angkasa adalah dengan mengorbit bumi terutama sekali pada orbit rendah bumi (LEO). Lokasi satelit, kapal angkasa dan stesen angkasa tersebut boleh ditentukan berdasarkan latitude dan longitude. Kapal angkasa tersebut dimodelkan sebagai badan yang kukuh dengan N sebagai roda simetri yang dikawal oleh tork sepaksi dan kinematiknya diwakilkan oleh Parameter Berubah Rodriquez (Modified Rodriquez Parameters). Perjalanannya menunjukkan perjalanan jujukan yang dijanakan oleh kapal angkasa virtual yang bersamaan dengan kapal angkasa yang sebenar. Kini, terdapat dua stesen angkasa di orbit rendah bumi iaitu Kapal Angkasa Antarabangsa (ISS) dan MIR (Rusia). Projek ini akan menghasilkan aturcara yang berupaya mengira kedudukan terkini dan akan dating bagi Kapal Angkasa Antarabangsa (ISS). Juga aturcara ini berupaya untuk membuat ramalan dan menjejaki lokasi masa sebenar Kapal Angkasa Antarabangsa (ISS) di orbit bumi.

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LIST OF ABREVIATION

PDA	-	Personal Digital Assistant
PC	-	Portable Computer
ISS	-	International Space Station
CPU	-	Central Processing Units
LCD	-	Liquid Crystal Display
OS	-	Operating System
RAM	-	Random Access Memory
LAN	-	Local Area Network
TLE	-	Two-Line Element
SGP	-	Satellite Geostationary Perturbation
LEO	-	Low Earth Orbit
HEO	-	Highly Elliptical Orbit
GEO	-	Geostationary Orbit
VB	-	Visual Basic
Net	-	Networking
GUI	-	Graphic User Interface

LIST OF APPENDIX

CHAPTER 1

INTRODUCTION

This chapter will discuss about project background, objective and scope project, problem statement, and project workflow and project methodology.

1.0 PROJECT BACKGROUND

Nowadays, electronic terms is widely used in our life because its can help people to handle their life such as tracking system. Lately, a lot of electronic devices and peripherals have been invented such as digital electronic, mobile phone, notebook and others. This project idea came out from satellite communication that gives us information about their spacecraft in earth orbital. This system was developed to enable users to track their space station before taking the irreversible step of allowing the satellite company to tell the detail of their own spacecraft that not all people can know very well. Now, with this system of Space Station Tracking System, the student, parent even household that have one of their family is an astronauts is easy to keep track where is the spacecraft is located near the earth orbit.

This project is divided into two major part; hardware and software. For hardware part, PDA and PC are used which it is a main of this project and control this part. The output of programming and interface will be appeared at PC monitor while PDA just showed the interface of this system. Both of these devices will let us know the latitude and longitude of the spacecraft. From that information and data people will know where exactly the location of the spacecraft that around the earth orbit is. For software part, VB.Net and Matlab 6.5 is used for interfacing between hardware and software and combined together to make this project was complete. Microsoft Visual Basic Networking software is used which it is to provide the graphical user interface. This project also applied to NASA, school, home, industrial and others. So, this project was preferred for astronauts at the space station to know where there are because there are not just in one location and always go round the earth orbit.

1.1 OBJECTIVES AND SCOPE OF PROJECT

This project will discuss about the objectives of project, scope of work, problem statements and briefly explained about the methodology that has been done in this project.

1.1.1 Objective Project:

This project is carried out on the following objectives:

To determine the latitude and longitude for the location of the satellite, spacecraft or space station and at the same time to learn about Personal Digital Assistant (PDA)

programming that can handheld computing device used to process, store and access data while away from one's desktop computer. Furthermore it is also to show spacecraft or International Space Station (ISS) orbit in two or three dimension display and finally to develop software for Personal Digital Assistant that has tracking system for space station.

1.1.2 Scope of Work

Scope of work for this project can be dividing into four parts:

a) Developing Software for PDA programming that can tracking system for space station.

b) Simulation using Matlab for latitude and longitude calculation for location of the satellite, spacecraft or space station.

c) Hardware – Personal Digital Assistant (PDA) in implementing developed software and PC (Portable Computer).

d) Orbital mechanic's knowledge based on program time at LEO (Low Earth Orbit)

1.2 PROBLEM STATEMENT

Nowadays, a lot of system related to space station can be obtained but not many know of the Space Station Tracking System. Through this program that is being develop, people are able to know of a certain space station's location.

We also found that from space station discussions, astronauts are definitely in the main topic. In an era where technology is becoming more advance from time to time. Therefore, this program is especially for the astronauts and public to detect the movement of the space station that orbits the earth satellite.

In the process of developing this program there where a few problems accoutered due to a new program being developed and it involves the wide-open space. Below are a few obstacles to realize this program:

1. No software built yet for this system so it's difficult to access information for spacecraft location anywhere.

2. To crack PDA coding in order to accept software.

3. No software was developed compatible for this system using PDA usage.

4. There is no device yet design for its practicality in usage whether on earth or outer space. Basic necessity of the device should be; battery life is long, easy to use anytime anywhere, and can add software and programs. For now, device to cover all specification of the above is PDA.

1.3 SYSTEM OPERATION

From the above block diagram, we can see that using Matlab 6.5 derives the input from latitude and longitude simulation. Whereas for PDA, input obtained are from converted Matlab programming product into VB.net. Both hardware go through the same process flow where program design is needed to develop both hardware. For the system needed for PDA, its software package will be directly directed into it or through the PC. Meanwhile for PC, it will analyze the developed program through Matlab where the interface design can be seen and understood better. This is because the given PDA can only store limited size file and can't receive large data or information. Continuing to do so will cause error to the program.

Hence, both Matlab and VB.net program is needed to develop this program successfully.

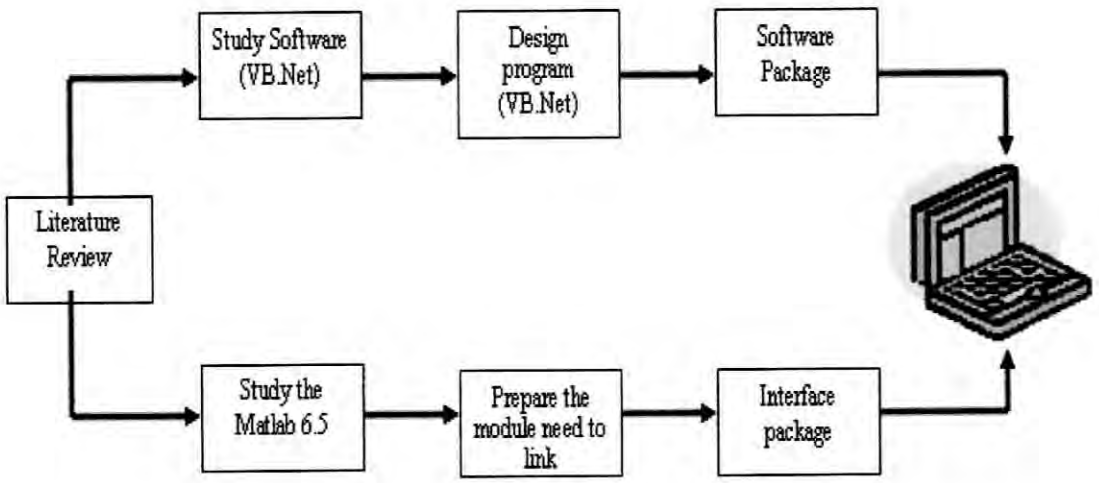

Figure 1.1: Overall Block Diagram of the PC Interface

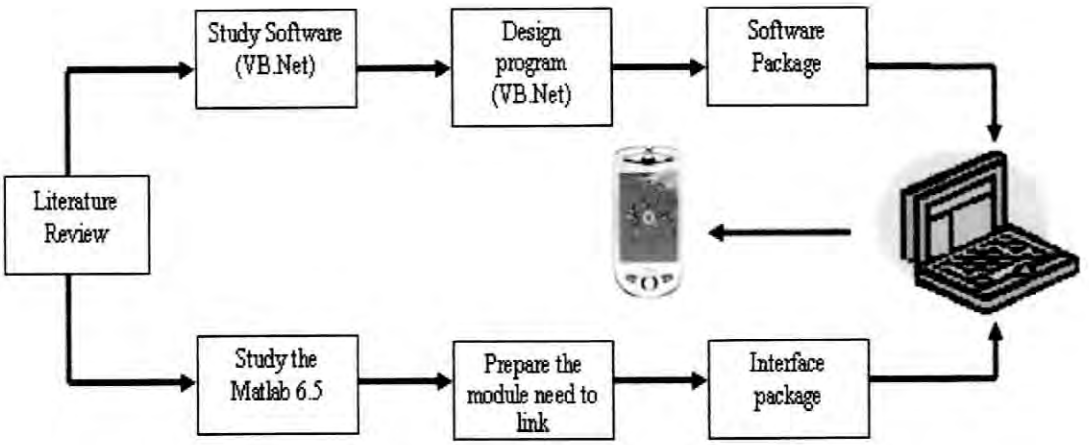

Figure 1.2: Overall Block Diagram of the PDA Interface

1.4 REPORT STUCTURE

At first chapter is all about the introduction of the project. It narrates the overview of the project including objective, problem statement and scope project. At second chapter, it discuss about literature review regarding to the project. At third chapter it talks about methodology of the project. In chapter four it focuses on result and analysis of the project. For the last chapter, chapter five it contained discussion of the project and also conclusion.

CHAPTER II

LITERATURE REVIEW

In this chapter, the backgrounds of this project will discuss and also explain about the improvement of this project from analysis and logical theory from literature review

2.0 OVERVIEW

Communication is an integral component of the International Space Station (ISS). Without extensive communication with the ground, scientific research, along with the safe, efficient, and reliable operation of ISS is not possible. The first proposal for a manned station occurred in 1869, when an American novelist told the story of how a "Brick Moon" came to orbit Earth to help ships navigate at sea. In 1923, Romanian Hermann Oberth was the first to use the term "space station" to describe a wheel-like facility that would serve as the jumping off place for human journeys to the moon and Mars. In 1952, Dr. Werner von Braun published his concept of a space station in Collier's magazine. He envisioned a space station that would have a diameter of 250

feet, orbit more than 1,000 miles above the Earth, and spin to provide artificial gravity through centrifugal force.

The Soviet Union launched the world's first space station, Salyut 1, in 1971 - a decade after launching the first human into space. The United States sent its first space station, the larger Skylab, into orbit in 1973 and it hosted three crews before it was abandoned in 1974. Russia continued to focus on long-duration space missions and in 1986 launched the first modules of the Mir space station. In 1998, the first two modules of the International Space Station were launched and joined together in orbit. Other modules soon followed and the first crew arrived in 2000.

2.1 SPACE STATION

The spacecraft is modeled as a rigid body with N ax symmetric wheels controlled by axial torques, and the kinematics are represented by Modified Rodriquez Parameters. The trajectory denoted the reference trajectory, is one generated by a virtual spacecraft that is identical to the actual spacecraft.

The figure below showed the Russian (MIR) space station that coverage is nearly continuous while using Russian ground stations, which are available for a portion of an orbit. Russia's launch tracking and data relay satellite provides coverage for about 45 minutes per orbit.

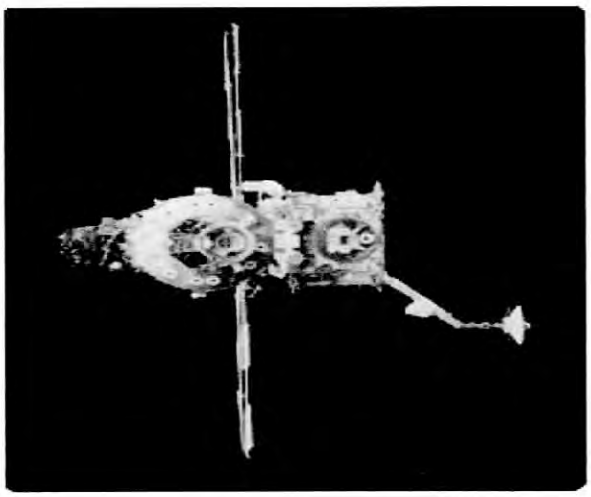

Figure 2.1: The Russian (MIR)

Meanwhile, the International Space station (ISS) Tracking and Data Relay Satellite System satellites orbiting at an altitude of 22,300 miles. The satellites pass the signals directly to and from the U.S. segment of the ISS at a rate equivalent to sending the contents of the entire encyclopedia Britannica every second.

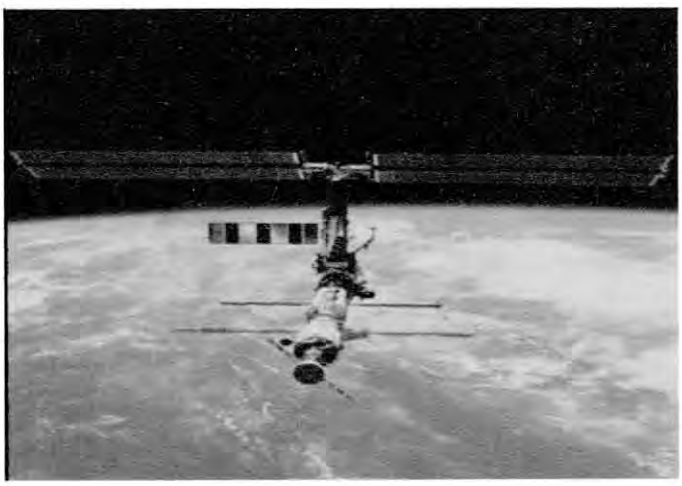

Figure 2.2: The International Space Station (ISS)