Gps Essay, Research Paper

Have you ever been fishing all day and it wasn?t going well, until the end of the day when you just found the perfect hot spot. But the problem is that night is about to come and you have to get your boat back to the dock before darkness falls. And you don?t want to leave because you are just finally starting to catch big fish and you know you won?t be able to find that spot again. So what do you do? You can rely on dumb luck and hope you can find that spot again? Or you can buy a Global Positioning System (GPS) that will help you find that spot again within 100 meters. A fisherman?s dream weapon against the enemy, the fish.

The Global Positioning System is a constellation of 24 satellites that orbit the Earth. When these satellites are used with a GPS receiver, makes it possible for a person to pinpoint their geographic position. GPS uses these satellites as reference points to calculate positions within meters. It was the U.S. Department of Defense (DOD) that decided that the military needed a very precise form of worldwide positioning. The DOD spent $12 billion dollars and now they have the greatest navigational system in the world. The GPS is funded and controlled by the DOD, the system was designed for and is operated by the U.S. military. The first GPS satellite was launched in 1978. The next ten satellites ware developmental satellites, called Block I. From 1989 to 1993, 23 satellites were made called Block II. In 1994 the 24th satellite was completed and the Global Positioning System was born and ready for use. Now civilians are swamping the market.

The GPS consists of three interacting components: 1) The Space Segment (satellites) 2) The Control Segment (monitoring stations) 3) The User Segment (receivers).

The Space Segment consists of 24 GPS satellites orbit the earth every 12 hours on the same ground track each day. The satellites are launched into space at an altitude of 10,900 nautical miles (12,000 km). There are six orbital planes on which the satellites travel on. Four satellites are on each one of these planes, and they are spread out evenly sixty degrees apart, and inclined fifty-five degrees from the equator. With the satellites positioned like that, there are always four to six satellites visible from any point on earth. Each satellite transmits two signal L1 at (1575.42 MHz) and L2 at (1227.60 MHz). The L1 signal is modulated with two pseudo-random noise signals the protected code and the coarse/acquisition code. The L2 signal only carries the protected code. Every satellite transmits a code that is unique to itself, this allows the GPS receiver to identify the satellite signal. Each satellite is equipped with clocks that are accurate to three nanoseconds, or 3 billionths of a second. These clocks are checked each day from the monitoring stations.

The Control Segment is a network of monitoring stations around the world. There are five monitoring stations in the world and they are: The Ascension Island in the Atlantic Ocean, Diego Garcia in the Indian Ocean, Kwafalein in the Pacific Ocean, Hawaii in the Pacific Ocean and Schriever Air Force Base in Colorado Springs, Colorado. Schriever AFB is the Master Control Monitor Station and the rest are just monitoring stations. Schriever AFB Control Station is the station that sets the clocks to the atomic clock at the U.S. Naval Observatory. The control stations send data to the GPS satellites and the satellites return data like the position of the satellite and its clock time. Then the control stations can correct and monitor the satellites position in time, location and clock. The DOD set the Selective Availability (SA) to 100 meters for security reasons. In 2006 the U.S. DOD will set the SA to zero making accuracy within 24 meters.

The User Segment is the GPS receiver and the user. GPS receivers convert the satellite signals into position, velocity, and time. For the GPS to work perfect they need four satellites signals to compute the four dimension X, Y, Z (positions) and Time. With the four signals the receiver then computes the latitude, longitude and altitude within 100 meters. Some receivers are also capable of calculating velocity. The receivers are made for aircrafts, ships, vehicles and portables for people. One popular feature of the GPS is its mapping ability. The receiver is connected to, or built with a map database and can actually show a person where they are in relation to highway, a restaurant or a landmark. Scientists use GPS to measure movements of arctic ice sheets, the Earth?s continental plates, and volcanic activity. GPS are susceptible to errors through noise, bias, and blunders. The noise is a combination of code noise and noise within the receiver. The bias is Troposphere delays because of changes in temperature, pressure, and humidity. Blunders are mistakes due to computer or human error and these errors can be from one meter to hundreds of kilometers. GPS receivers receive the best signals from the satellites when they are in positions that make large angles from each other. Then they are poor when they are close angles to each other. The receivers can be categorized into a couple of groups: 1) low-costs most common to the civilian user (100 meter accuracy), 2) medium-cost (1 to 10 meters accuracy), 3) high-cost, single receiver ( 20 meter accuracy), and 4) high-cost ( 1 mm to 1 cm accuracy).

In conclusion the GPS is one of history?s most exciting and revolutionary developmental projects ever. Though it was designed as a guidance and navigational tool for the military. The civilian sector has found many uses for its capabilities. The GPS use for civilian use has grown faster than any one person could predict. Its use in the fields of transportation, surveying, rescue operations and recreational uses has benefited everyone greatly.

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