**DUNMOYE AKEEM O.**

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**CIVIL ENGR.**

1. **DISCUSS THE BENEFITS OF GPS OVER OTHER FORMS OF EQUIPMENT FOR MEASURING.**

1. Navigation

Perhaps the most common use for GPS is in navigation systems. Combined with map technology, it becomes a powerful tool for road vehicles and boats. GPS can pinpoint a device's location with accuracy and by comparing coordinates, the statistics can be used to calculate a devices direction of movement and speed. This information can be used to provide step-by-step directions from Point A to Point B in real time.

2. Low Cost

The satellites behind GPS are paid for, maintained and upgraded by the US Department of Defense. That means that the system is essentially free, although you may have to pay for a device and software to utilize it. Smartphone apps, such as Google Maps, that use GPS are also usually free.

3. Crime and Security

GPS can be used as a valuable tool by law enforcement to track criminals or terrorists, using devices they attach to vehicles, or through tracking the perpetrator's smartphone. GPS tracking devices can also be used to deter theft by employers or ordinary people.

4. Easy to Use

Navigation using GPS is generally very easy and requires minimal skill or effort, certainly when compared to traditional methods and technologies, such as map-reading. In most cases, the user just has to input the destination and the device will do the rest. GPS is also an easier and more efficient technology to use for tasks like surveying and the study of the movement of tectonic plates

5. Employer Monitoring

Employers can use GPS tracking to make sure that their drivers are behaving responsibly, such as following the quickest route, and not wasting time or fuel by going off track, as well as following speed restrictions. Businesses can also provide better customer service if they know where delivery or service vehicles are at any one time. A fleet of vehicles can be used more efficiently using GPS.

6. Safety

GPS tracking can be used by parents to keep tabs on their children. Spouses can also use similar technology to keep track of their partners. Workers and others can also use GPS tracking for personal safety, so that their whereabouts are known if there is an emergency.

7. Neighborhood Search

As well as navigation, GPS can also be used to provide information on the local area. For instance, finding out where the nearest hotel or gas station is, or discovering nearby restaurants that are open for business. This is convenient when you are on a long road trip and need to find a place to stop for food, gas, sleep, and so on.

8. Traffic and Weather Alerts

One of the nice things about GPS is that it is all happening in real time. That means that you can be notified if there is a traffic accident or other hold-up ahead, or if you are approaching an area where there is a severe weather event occurring. Not only can this shorten your journey time, but also improve safety

9. Available Anywhere

One of the best features of GPS is that because it essentially works through satellite technology, it is available across the entire globe. There is no need to be caught out not knowing your own location, or get lost.

10. Updated and Maintained

The GPS system is paid for, updated, and maintained by the US Department of Defense, so that it is always accurate. Most software, apps, and devices that use GPS are also regularly updated, normally for free. So unlike a traditional printed map which goes out of date after a while, GPS and related technology normally stays very accurate.

11. Exercise Monitoring

GPS can be used for exercise monitoring and can help amateurs to improve their health and fitness, as well as professional sports men and women. It can be used to calculate speed, distance traveled, and even use the information to estimate calories burned.

12. Flexible Route Options

GPS give you route choices in live time, enabling flexibility. You can choose a route according to your particular needs or desires. If you take a wrong turn, a new route can be calculated using GPS. If your route becomes blocked by an incident, GPS can be used to calculate a new pathway.

13. Military Usage

As well as being useful for navigation and other general uses, the military employs GPS when setting targets for guided missiles. GPS improves accuracy through giving the missile a specific set of coordinates, and reduces collateral damage through increased accuracy.

14. Surveying

Land surveying takes place before construction or development. Over time, GPS has gradually replaced traditional land surveying techniques, mainly because it is cheaper, quicker, and usually more accurate. It often takes hours with GPS, rather than days.

15. Buildings and Earthquakes

There are many scientific applications of GPS beyond just navigational matters. It can be used to help detect structural problems in roads and buildings, as well as predict natural disasters like earthquakes through the monitoring of tectonic plate movement.

1. **TYPE OF ERRORS ASSOCIATED WITH ABSOLUTE GPS POSITIONING MODE**
2. **EHEMERIS ERRORS AND ORBIT PERTURBATIONS** : Satellite-ephemeris errors are errors in the prediction of a satellite's position, which may then be transmitted to the user in the satellite data message. Ephemeris errors are satellite dependent and are very difficult to correct completely and compensate for, because the forces acting on the predicted orbit of a satellite are difficult to measure directly. The previously stated accuracy levels are subject to the equipment's condition and performance. Ephemeris errors produce equal error shifts in the calculated absolute-point positions.
3. **CLOCK STABILITY****:** The GPS relies very heavily on accurate time measurements. GPS satellites carry rubidium and cesium time standards that are usually accurate to 1 part in 10 trillion and 1 part in 100 trillion, respectively, while most receiver clocks are actuated by a quartz standard accurate to 1 part in 100 million. A time offset is the difference between the time as recorded by the satellite clock and the time recorded by the receiver. A range error that is observed by the user as a result of time offsets between the satellite and receiver clock is a linear relationship and can be approximated.Unpredictable transient situations that produce high-order departures in clock time can be stored for short periods of time. In a plane survey, departure is defined as the difference between the castings of the two ends of the line, which may be either plus or minus. Predictable time drift of the satellite clocks is closely monitored by ground-control stations. Through close monitoring of the time drift, the ground-control stations are able to determine second-order polynomials that accurately model the time drift. These second-order polynomials, determined to model the time drift, are included in the broadcast message in an effort to keep this drift to within 1 millisecond. The time synchronization between the GPS satellite clocks is kept to within 20 nanoseconds through the broadcast-clock corrections as determined by the ground-control stations and the synchronization of GPS standard time to the universal time, coordinated (UTC) to within 100 nanoseconds. Random time drifts are unpredictable, thereby making them impossible to model. GPS receiver-clock errors can be modeled in a manner similar to GPS-satellite-clock errors. In addition to modeling the satellite-clock errors and in an effort to remove them, an additional satellite should be observed during operation to solve for an extra clock offset parameter along with the required coordinate parameters. This procedure is based on the assumption that the clock bias is independent at each measurement epoch. Rigorous estimation of the clock terms is more important for point positioning than for differential positioning. Many of the clock terms cancel each other when the position equations are formed from observations during a differential-survey session.
4. **IONOSPHERIC DELAYS****:** GPS signals are electromagnetic signals and as such are nonlinearly dispersed and refracted when transmitted through a highly charged environment like the ionosphere. Dispersion and refraction of the GPS signal are referred to as ionospheric range effects, because dispersion and refraction of the signal result in an error in the GPS range value. Ionospheric range effects are frequency dependent.The error effect of ionosphere refraction on GPS range values is dependent on sunspot activity, the time of day, and satellite geometry. GPS operations conducted during periods of high sunspot activity or with satellites near the horizon produce range results with the most amount of ionospheric error. GPS operations conducted during periods of low sunspot activity, during the night, or with a satellite near the zenith will produce range results with the least amount of ionospheric error. Resolution of ionospheric refraction can be accomplished by using a dual-frequency receiver (a receiver that can simultaneously record both L1 and L2 frequency measurements). During a period of uninterrupted observation of the L1 and L2 signals, these signals can be continuously counted and differenced. The resultant difference shows the variable effects of the ionosphere delay on the GPS signal. Single-frequency receivers used to determine an absolute or differential position typically rely on ionospheric models that predict the effects of the ionosphere. Recent efforts have shown that significant ionospheric-delay removal can be achieved using single-frequency receivers.
5. **TROPOSPHERIC DELAYS****:**. GPS signals in the L-band level are refracted and not dispersed by the troposphere. Tropospheric conditions that cause refraction of the GPS signal can be modeled by measuring the dry and wet components.
6. **MULTIPATH EFFECT****:** . Multipath describes an error that affects positioning and occurs when the signal arrives at the receiver from more than one path. Multipath normally occurs near large reflective surfaces, such as a building or structure with a reflective surface, a chain-link fence, or antenna arrays. Multipath is caused by the reflection of the GPS signal off of a nearby object, which produces a false signal at the GPS antenna. GPS signals received as a result of multipath give inaccurate GPS positions when processed. Newer receiver and antenna designs and thorough mission planning can minimize multipath effects as an error source. The averaging of GPS signals over a period of time can also reduce multipath effects.
7. **RECEIVER NOISE****:** . Receiver noise includes a variety of errors associated with the ability of the GPS receiver to measure a finite time difference. These errors include signal processing, clock/signal synchronization and correlation procedures, receiver resolution, and signal noise.
8. **S/A AND AS** **:** . S/A purposely degrades the satellite signal to create position errors by dithering the satellite clock and offsetting the satellite orbits. The effects of S/A can be eliminated by using differential techniques. AS is implemented by interchanging the P-code with a classified, encrypted P-code called a Y-code. This denies users who do not possess an authorized decryption device. Manufacturers of civil GPS equipment have developed techniques, such as squaring or cross correlation, to make use of the P-code when it is encrypted.