Review of an Accurate System Utilizing GPS Technology

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Abstract

GPS provides precise position and control data anywhere on the planet and in any weather condition. GPS was originally intended for military usage, but in the 1980s, the US Department of Defense made it available for civilian use. The scientific applications of GPS in the military, community, and commercial sectors are expanding on a regular basis. Agriculture, construction, mining, measurement, package delivery, and logistical supply chain management all benefit from GPS technology. Precision GPS time synchronization is critical for big networks, navigation, finance systems, financial markets, and power grids. Wireless services are impossible to imagine without them. In this paper, we will go over the key aspects of GPS technology as well as a discussion of the systems that use it.

Keywords: GPS, GPS applications, and GPS technology.

DOI Number: 10.48047/NQ.2022.20.21.NQ99032 **Neuro Quantology 2022; 20(21): 247-250**

1. Introduction

The atomic clocks on GPS satellites are synchronized with one another and with terrestrial clocks. Any variation from the specified time is periodically adjusted. satellite monitoring GPS receiver clocks are out of sync with real-time and, as a result, less stable. The GPS system observes numerous satellites at the same time and solves equations in real-time to update the receiver's true location and departure. In order to determine variable values, the receiver must observe the satellite's coordinates and clock deviation. GPS satellites orbit the Earth every 24 hours. Each satellite broadcasts a unique signal as well as orbital data, which GPS systems decipher in order to identify it. GPS receivers use this data and trilateration to locate users. The time it takes for a GPS receiver to receive a signal is used to compute satellite distance. The receiver may be able to determine a user's location by obtaining distance measurements from additional satellites. GPS can also monitor speed, heading, and location. The future of GPS analysis will include improved device downsizing, longer battery life, and integration of data from other inertial sensors [1][2] .

GPS is made up of three different parts that work together to give you directions. GPS position data is separated into three categories:

Space (Satellites): Satellites that orbit the Earth and provide users with information.time of day and geographical location

- Ground control: Earth-based monitor stations comprise the Control Segment.
- A ground antenna and master control stations
- GPS receivers and transmitters, including watches, are examples of user equipment.
- Smartphones and tracking devices

2. GPS Applications

The oldest science has become a major topic in the geosciences because of the advancement of

GPS capabilities over the last 35 years. GPS geodesy's capacity to estimate 3D positions with millimeter-level precision has led to discoveries in geophysics, seismology, atmospheric science, hydrology, and natural hazard science. Monitoring GPS sensor placements or trajectories on Earth's land and ocean surfaces, in the atmosphere, or in space is vital for theory and applications, such as understanding tectonic and magmatic processes and limiting the impact of natural hazards on society and the environment. Example uses[3]:

A. Traffic Congestion.

B. worldwide military, civic, and commercial users

C. Tectonics: GPS allows for the measurement of earthquake fault motion in terms of ground motion and position

D. Terrorism and GPS: GPS is crucial for determining the location of terrorists. attacker

E. GPS for mining: Using RTK GPS has made a big difference in many mining tasks. Drilling, digging, vehicle tracking, and surveying are all possible with RTK GPS. positional precision to the centimeter

F. Navigation: Navigators rely on digitally precise speed and direction. sizes.

G. Disaster Relief: Use GPS to determine the precise location and time. Earthquakes, flash floods, and wildfires

H. GPS is used to find and route cars and trucks in an automated vehicle. to drive in the absence of a human

I. Agriculture: GPS-based precision farming applications, field mapping, and planning are being used on farms.

3. Related works

Some of system that developed based on GPS technology are :-

In 2014, Mohammed Salah created and deployed a time-and-attendance system. GPS is used to locate every business. An employee can be found using GPS (GPS watch, GPS-enabled device, mobile phone, etc.). If an employee's location and the location of the company are almost the same, the employee is at work. The study suggests a revolutionary time and attendance system based on geography[4].

Su and Lee (2016) proposed embedding a loop antenna inside a smartwatch's steel frame. By precisely matching the top metal frame's shorts, the projected loop antenna may provide a 1575 MHz GPS for smartwatches[5].

R. C. Jisha and colleagues (2018) app for bus tracking and student monitoring. The software tracks school vehicles. An Android app can communicate with a server. The device tracks vehicles and attendance. Drivers, faculty, teachers, parents, and administrators use it. The program uses GPS and GPRS/GSM. This Android app lets parents track the bus and watch their kids[6].

Johansson and colleagues (2020) tested the GPS sports watches over a 56-kilometer run. The distance accuracy of these GPS sports watches ranges between 0.6% and 1.9%. This demonstrates that GPS sports watches are a viable and feasible method for coaches to assess performance and training load. While reviewing the data, minor inaccuracies must be taken into account[7].

In 2021, Javier Lluch and colleagues will put marathon GPS models to the test. It collects information from marathon runners. On 85 devices, they discovered 73,865 GPS records. The accuracy of road GPS equipment differs from that of trail GPS units and cell phones. Athletes may be able to obtain a more precise pace and other metrics during a marathon by using this data[8].

Michal Vorlek and colleagues 2021 compared a low-cost GPS receiver (the Holus RCV-3000) and a popular Garmin Forerunner 35 smartwatch against a device approved for physical activity research (the Qstarz BT-Q1000XT). These instruments were installed at six different geodetic locations (e.g., open spaces, parks, and housing). The coordinates of each gadget were compared to known geodetic sites. The three devices' accuracy was consistent across all six sites. In the city center, the Garmin was more precise, while the Holux was more accurate in the park and housing estate areas. [9].

Jane Chung and colleagues (2022) investigated the use of GPS watches to assess life-space mobility (LSM) and health in elderly individuals. 3 days with 30 Fitbit flows GPS generated eight spatial and temporal LSMs. 90% of in-home movement speeds were zero, indicating inactivity, but distance and area indicated busy out-of-home travels. Total distance and 95th percentile movement speed differed by cognitive category. These studies suggest that GPS watches can monitor health for preventative purposes[10].

Anisha Cullen and colleagues discussed wearable and portable GPS in 2022. Cognitive decline and mobility difficulties accompany disease development. More people are retiring and traveling. Caregivers use GPS to find lost dementia patients (PwD). They monitor PwD movement patterns non-invasively[11].

Chong Shen and colleagues plan to develop a new adaptive Kalman filter in 2022. A MEMS-INS/GPS/polarization compass Kalman filter (MR-STSCKF) is proposed. The filter alters the calculations of system covariance. The proposed technique may overcome sensor sample frequency variations while retaining navigational accuracy. Experiments show that MR-STSCKF enhances a high-sampling-rate MEMS-INS/GPS/polarization compass integrated navigation system[12].

Jhilam Jana and colleagues claim that by 2023, they will have developed a cost-effective IoT-based system for tracking COVID-19 patients. The proposed strategy could lessen the likelihood of this hazardous virus spreading in the community. Low-cost technology that can be used more than once can help hospitals and city governments keep track of and watch over their citizens on their own[13].

4. Conclusion

The hypothesis of this study was that GPS is an accurate and reliable method for the determination of speed over ground. The results show that GPS is generally accurate for speed determination under all conditions. In this paper, we went through the main features of GPS technology and review on the systems that utilities from this technology. we are selected some system from the 2014 to 2023 and the results shows that the GPS offers accurate location and control data anywhere in the world and in any weather condition.

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