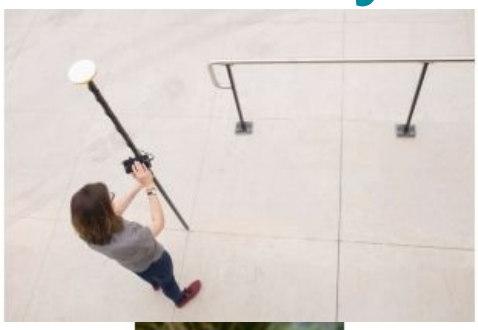
PAY-AS-YOU-GO SOFTWARE-DEFINED GNSS

Precisely Flexible Positioning



As users push for more capabilities, today's location apps for smartphones and tablets are running up against frustrating limitations. Higher accuracy can increase the performance of location-aware applications, but the costs and complexity have presented barriers to entry for many potential developers and their customers. Now, the Trimble Catalyst software-defined GNSS receiver is shifting the emphasis from hardware to software and cloud-based services, and is set to bring new users to the GNSS arena.

GPS first appeared on mobile phones in the mid-1990s, but the concept of location-based services using a device's built-in GPS receiver did not really take hold until the advent of Apple's iPhone 3G. Nowadays, the current location apps for smartphones and tablets are running into some frustrating limitations as users push for more capabilities. One of the biggest concerns is the accuracy and reliability of GPS positions. Smartphones need connection to cellular networks to achieve their stated GPS accuracy. Even in good conditions, achieving an accuracy of better than one or two metres is beyond the capability of consumer-style phones or tablets. Higher accuracy can increase the performance – and value – of location-aware applications, but the costs and complexity of high-accuracy GNSS solutions have presented barriers to entry for many potential developers and their customers.

Positioning-as-a-Service

In late 2016, Trimble introduced Trimble Catalyst, a software-defined GNSS receiver that works with selected Android mobile handhelds, smartphones and tablets. The solution includes software running on the handheld, a small digital antenna and a subscription to the Catalyst service. With Catalyst, users can obtain positions in real time with accuracy ranging from metre level down to two centimetres.

Software-defined GNSS receivers were first envisioned over a decade ago, but they have only recently been made practical by advances in the processing power of small devices, highly efficient computing algorithms and the development of cloud- or satellite-based correction services. To use Catalyst, the user connects the small, separately purchased DA1 antenna to the smartphone or tablet using a USB cable. The DA1 is powered by the phone and contains a patch antenna and analogue-to-digital converter. It has a standard threaded connection for mounting on a pole or other mount. The antenna delivers raw GNSS observations to the smartphone, where they are combined with correction data from the Catalyst subscription service. Users can choose from different levels and price points of precision. Monthly subscriptions are available at metre, sub-metre, decimetre and two-centimetre accuracies. Catalyst automatically selects the optimal signals, either via wireless internet or satellite delivery.

Application Development

Location-aware applications can obtain positions from Trimble Catalyst via Android's location service framework. However, if a software provider wants to have better control over the integration, such as outputting the position in local coordinate systems or faster position updates, they need to integrate Catalyst into their application. To facilitate this, application developers can use Trimble's Precision software development kit (SDK) to access Catalyst functionality.

In addition to managing the software-defined GNSS receiver, the SDK enables applications to use positioning metadata such as accuracy estimates and satellite information. Because the SDK can link to any application running on the smartphone or tablet, developers can incorporate accurate positions into existing user interfaces. Trimble provides the SDK to developers at no charge.

New Users, New Directions

Trimble is actively supporting third-party developers working to adopt the Catalyst approach. One example is in the UK, where Trimble distributor Korec develops and sells its own GIS applications. The solutions run on bring-your-own-device (BYOD) platforms including smartphones and tablets and often rely on the device's built-in GPS receiver for basic positioning. In order to provide increased accuracy, the software can connect to external GPS or GNSS receivers or use the Catalyst approach.

Catalyst also supports Trimble TerraFlex software: a cloud-based mapping and GIS field solution that operates on a variety of Android devices. Companies that use TerraFlex will be able to achieve high-accuracy positions when needed by switching on a monthly subscription for high-accuracy corrections. For other operations, they can operate at lower precision – and lower cost – while using their existing forms and work flows.

An example of where such an application could be used is in asset management, where knowing an asset's location to within a decimetre can save time and money in maintenance, repairs and lifecycle management. However, the additional cost and more complex workflow of a high-precision external receiver can be a drawback – especially when the users are not skilled in geospatial techniques. The cost concerns can grow when businesses employ many field technicians who only occasionally need decimetre or centimetre precision.

Accuracy is also important in augmented reality. Solutions from manufacturers such as New Zealand-based Augview can load the as-constructed data from a utility or municipal GIS database to a tablet or smartphone. Using position and orientation from onboard sensors, the software can superimpose the location of underground utilities onto a georeferenced view of an area as seen by the device's built-in camera. The solution enables field workers to visualise otherwise invisible objects.

Because augmented reality places digital objects into the view of the physical world, users can quickly spot any errors or inconsistencies in the positioning of objects. If these occur too often, users can lose confidence in the solution. Ironically, many users are unwilling or unable to pay for higher precision. But locating buried objects as well as producing the augmented views requires positioning accuracy beyond the capability of most BYOD solutions. As-constructed data is often collected by survey teams and may be more precise that the capability of handheld devices used by utility field technicians. For many clients, factors such as the cost, size and weight of an external GNSS receiver often outweigh the benefits of more accurate positioning. For these users, the software-defined GNSS receiver is an attractive alternative to using high-accuracy GNSS positions.

Do the Numbers Work?

For years, professional-grade GNSS hardware has come at a price point that has limited access to high-accuracy positioning. But with Catalyst, cost is no longer a barrier to entry to those wanting to add GNSS to their workflows. By shifting the emphasis from hardware to software and cloud-based services, Catalyst is positioned to bring new users to the GNSS arena.

In spite of Catalyst's potential, existing GNSS hardware isn't going away. Engineers and surveyors need high-performance systems and will continue to use specialised GNSS solutions. The subscription approach used by Catalyst is in line with the licence structure used by many software vendors in the geospatial and engineering segments, with software products often available on a subscription basis. Larger organisations might purchase the solutions as long-term capital expenditures, but smaller organisations and many subcontractors prefer to allocate costs to specific projects and can let subscriptions lapse during slow periods. Depending on usage, both groups could benefit from the Catalyst approach of software-defined receivers and subscription-based positioning services.

As Catalyst moves into the market, the combination of low cost and open access to third-party developers will play a key role in the growth of the system. Trimble is working closely with developers and distribution partners to bring their applications to life. The experiences and feedback of users and developers will reveal new – and perhaps unexpected – applications and markets for precise positioning.