Positioning as a Service for Fit-for-Purpose Applications

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SUMMARY

Traditionally, the value and cost of positioning technology has been placed into physical hardware devices, making it challenging to gain high spatial accuracy or vary the required accuracy needed for a project without facing significant equipment transition costs. This paper seeks to present the new Soft GNSS technology concept and provide real world examples where positioning-as-a-service can provide technology solutions versatile enough to be an essential fit-for-purpose tool.

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1. INTRODUCTION

Traditionally, the value and cost of positioning technology has been placed into physical hardware devices, making it challenging to gain high spatial accuracy or vary the required accuracy needed for a project without facing significant equipment transition costs. This paper seeks to present the new Soft GNSS technology concept and provide real world examples where positioning-as-a-service can provide technology solutions versatile enough to be an essential fit-for-purpose tool.

In general, high-accuracy GNSS solutions require three components:

- Antenna: hardware that can receive high fidelity (quality) signals from GNSS satellites
- Receiver: signal processing and generation of position solution
- Corrections: a data stream that aids the receiver in creating a high accuracy position solution

In standard practice today, these three components are all bundled in to the same physical unit. Soft GNSS technology introduces a new concept to accuracy, where each component of the traditional GNSS solution is decoupled into individual, and in some cases, non-physical objects. Combined with the proliferation of smartphones and the bring your own device (BYOD) model, it is now possible to bringing positioning technology to more areas and users than ever before.

2. THE CONCEPT OF POSITIONING-AS-A-SERVICE

As smartphones have become increasingly more powerful, and our access to cellular or satellite delivered signals and cloud solutions becomes even more common, technology is able to leverage this improved processing power. In this way, the physical GNSS receiver chip can be moved into a purely software-based algorithm, powered by the smartphone device. With the shift of the receiver components to be software based, this allows for a smaller, lighter weight antenna to be introduced purely for receiving high-quality satellite signals. The third component of the GNSS solution, correction services, can also be moved to be software based and cellular delivered.

With this modified configuration involving software and connectivity comes the opportunity for new delivery mechanisms, such as subscription-based as-a-service models, which can be leveraged to create the concept of positioning-as-a-service. By introducing versatility through flexibility in service and ongoing customization options instead of a one-time fixed solution, the needs of land administration projects can be more acutely met.

Figure 1: Soft GNSS and Positioning-as-a-Service on a Cadastra project in Luberizi, South Kivu, Democratic Republic of Congo

Historically, the acquisition of positioning technology for land administration projects has largely involved the purchase of hardware in a perpetual-style agreement. National Survey Organizations or Cadastral departments must typically spend significant time in advance of the purchase to quantify their positioning needs. Even with preliminary testing, these organizations can end up either over or under estimating their project needs. This can be incredibly costly, as traditional hardware configurations are often specified very tightly and, in some scenarios, errors can force a re-purchase of new equipment. This puts a large burden on the initial project purchase to get the solution right, and does not allow for changes or adjustments once the project is underway and operating in real working conditions. Additionally, the complexity of equipment and its cost can be a major barrier to engaging diverse workforces, especially when working with staff from non-surveying backgrounds.

The fit-for-purpose mandate calls for a practical selection of appropriate technology that is flexible to the diverse needs and conditions under which land administration projects occur. Key elements of this approach are inclusivity, participatory approach, affordability, reliability, attainability and upgradeability. Positioning-as-a-service, when enabled with soft GNSS technology, provides a pragmatic approach to recording and documenting the needs of people and their relationship to land.

3. BENEFITS OF POSITIONING-AS-A-SERVICE

Soft GNSS technology and positioning-as-a-service provide a unique approach to solving the positioning challenges presented in traditional land projects. For example, if the project has

varying accuracy requirements depending on the phase of execution, such as preliminary scouting followed by systematic cadastral survey, different subscriptions can be purchased each month, and delivered when needed to the active device. If up-front cost is an issue with a project, limiting accessibility to a solution, then a subscription model allows customers to have a much better ability to tailor their equipment to their needs, and allocate costs over the duration of the project instead of up front. Finally, since the initial start-up cost of the solution is lower, and includes readily available devices in comparison to traditional solutions, this can also allow for more mobilized workers. These benefits can be further proven through several examples.

Positioning-as-a-service enables a low-cost, yet scalable solution to an expanded audience. Industries and projects previously wanting to access GNSS positioning, but were unable to afford or practically acquire it, can now attain such tools for projects. A good example of this scenario is scouting for land development, or pre-assessment, where engagement of local community and stakeholders is a precursor to the project implementation. When considering traditional GNSS solutions, it would often be considered too expensive and time consuming to equip assessors or social scientists with an advanced positioning solution to capture data before survey crews arrive. However, by providing a sub-meter accuracy subscription for a specific time frame on an app powered by a smartphone, suddenly the information being gathered in the pre-assessment phase can be passed on to the subsequent teams, so that conflicts or discrepancies identified in the assessment can be communicated along with basic spatial information.

Positioning-as-a-service also introduces flexibility and simplicity to the traditional one-product-fits-all mentality, allowing the user to choose the correction service to match project requirements and make adjustments as needed based on budget, workforce, and timeline. It also becomes much easier to facilitate training and deployment of larger workforces when a familiar product like a smartphone and app is the interface for a positioning solution. As an example, on a wind farm development project, site managers typically use topographical maps and multiple site visits to determine the optimal location for installation of the wind turbines. This information is often communicated in a physical map and site managers typically need to escort the installation crews to the physical site. With positioning-as-a-service, as the workforce scales up for each turbine installation, even if installations are months apart, workers can digitally communicate information and navigate to each turbine location using a stakeout menu. Upon completion of construction, the map and information can even be updated in real time to reflect new changes.

4. CONCLUSION

By reducing the upfront cost, positioning-as-a-service enables a diverse workforce to participate in land administration projects with an accessible and useful solution. By offering different accuracy subscription levels, the technology solution is customizable, upgradeable, and can be relied upon to meet project specifications. Ultimately, positioning-as-a-service provides unprecedented flexibility in GNSS solutions, in accordance with the key principles of the fit-for-purpose methodology.

In summary, positioning-as-a-service and Soft GNSS are incredibly versatile and revolutionary technology enhancements that leverage readily available and accessible means to bring GNSS solutions to even more users than ever before.

REFERENCES

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BIOGRAPHICAL NOTES

Stephanie Michaud, P.Eng. is a professional geomatics engineer responsible for the application of geomatics engineering principles and techniques to coordinate the definition, development, testing, and delivery of custom land development solutions within the Land Administration division and Trimble Inc organizations. Mrs. Michaud holds a degree in geomatics engineering from the University of Calgary in Canada.

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