OXTS

SOLUTION BRIEF

Road-based mobile mapping

ROAD-BASED MAPPING RELIES ON ROBUST LOCALISATION

By its very nature, road-based mapping is popular in areas where GNSS signal is weaker or unreliable, such as urban canyons. In order to deliver the highest quality survey data, you need a localisation solution that keeps going in these environments, and supports smooth workflows to combine its data with your survey information.

In this solution brief, we'll be discussing the key localisation technologies available for road-based mobile mapping surveys, and answering key questions about developing a localisation solution for your mapping payload. We'll also show you how OXTS can help you get best-in-class localisation data for land-based surveying, whether you're using LiDAR, photogrammetry, hyperspectral imaging sensors, or something else.

ROAD-BASED MOBILE MAPPING LOCALISATION TECHNOLOGIES

There is a range of different technologies that can help you localise your road-based survey data. In this section we'll discuss the use cases and benefits of each – and show you how OXTS can help you build your solution.

GNSS-aided Inertial Navigation System (GNSS/INS)

A GNSS/INS uses a combination of satellite data and inertial measurements to estimate its position on the earth. Installing a GNSS/INS in your surveying payload allows you to collect position data at every point of your mission, which can then be used to georeference your survey data.

There are a few different methods of using a GNSS/INS to georeference survey data, and a few different types of GNSS/INS you can use.

Different methods of GNSS/INS localisation

Method 1:
Post-Process Kinematics (PPK)

PPK is a process that happens after the mission that applies various types of corrections to your localisation data to maximise its accuracy.

Method 2:
Real Time Kinematics (RTK)

RTK achieves a similar effect to PPK, but in real time. A GNSS/INS with RTK will give you more flexibility with where and how you can gather your data, however you may need to use correction services like NTRIP.

Different INS Technologies

Fibre Optic Gyroscope (FOG) INS

A FOG INS uses fibre optics to measure rotation. It's highly precise, and robust, but is also relatively large and expensive.

Micro Electromechanical System (MEMS) INS

MEMS INS technology is the most miniaturised INS technology on the market. Though the base accuracy and precision isn't as high as other technologies, they can be optimised and calibrated to deliver centimetre-level precision, and are much more affordable than FOG or RLG.

Ring Laser Gyroscope (RLG) INS

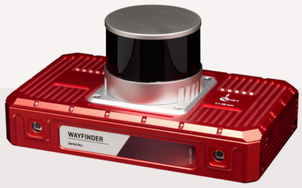
A RLG INS uses the same principles as a FOG INS, but uses lasers instead of fibre optics. RLG offers the best performance, but is extremely expensive and can't be miniaturised to the same level as a MEMS INS.

The OXTS GNSS/INS solution

OXTS GNSS/INS devices use a MEMS inertial measurement unit and two survey-grade GNSS receivers. Combined with careful calibration, sophisticated sensor fusion and an advanced navigation engine, they deliver FOG-level performance at MEMS pricing.

OXTS GNSS-aided Inertial Navigation Systems for road-based mobile mapping.

RT3000 v4



WayFinder

xNAV650

Real-time Sensor Fusion

Another option is to augment the performance of a GNSS/INS with additional sensor data, fed into the GNSS/INS' navigation engine in real time to compensate for bad GNSS data. A common sensor for this task is LiDAR.

While there are complexities in building a real-time LiDAR aiding system, it does offer centimetre-level precision in any environment, with a high degree of reliability and repeatability. There are two types of data that real-time LiDAR aiding can produce:

- Real-time LiDAR Inertial Odometry (LIO) updates which can be used to improve the reliability of position data in areas where GNSS signal is patchy.
- In a pre-surveyed environment, real-time LiDAR aiding can produce completely repeatable and highly accurate vehicle position information, using LiDAR map matching techniques, with no need for additional sensor data.

+ The OXTS real-time sensor fusion solution: WayFinder

WayFinder is a complete GNSS-denied localisation solution that works out of the box. Featuring integrated GNSS/INS, LiDAR, and camera sensors, WayFinder provides accurate localisation data indoors and outdoors – and seamlessly transition between them both.

The key benefit of WayFinder is that all the difficult work of integrating the sensors so that they provide accurate, repeatable data in real time has been done for you: our unique LiDAR Boost technology ensures a stream of high-quality localisation data for your project.

SLAM (Simultaneous Localisation and Mapping)

SLAM is a technique that allows a system to build a map of an unknown environment while simultaneously tracking its position within that map. Commonly used in autonomous navigation, SLAM can also be used in surveying to gather localisation data in environments where GNSS signals are unreliable or unavailable.

SLAM is very good at creating self-consistent data enabling navigation in unfamiliar spaces where there is no outside infrastructure that can be relied upon such as GNSS or UWB. Instead it can rely only on the onboard sensors and its perception of the world around it.

KEY CONSIDERATIONS

If you're not sure what type of solution is best for your work, the questions below should help you decide.

Where will you be surveying?

If your surveys only ever take place under open skies, then a GNSS/INS should give you sufficient performance. If you ever go into urban areas, or survey indoors, you'll need something more.

What processing power does your payload have?

As mentioned, solutions like SLAM are very computationally intensive. If your payload doesn't have its own processing power, or only has limited processing power, SLAM might not be appropriate.

How skilled are your engineers?

Some localisation solutions require lots of engineering expertise, coding, and testing to work. If you don't have those skills in-house, look for a solution that requires as little work as possible to integrate.

How will your solution affect profitability?

As mentioned, solutions using FOG or RLG technology are very expensive, and will affect the profitability of your surveys if you use them. A solution that balances performance with cost may make more sense, commercially.

How will my solution affect my workflow?

Gathering data is only half the story – you then need to combine localisation and survey data, and present it. Does your solution come with tools for smooth georeferencing workflows, or will it be a very manual process?

SMOOTHING THE ROAD TO SURVEYING SUCCESS

There is a range of technologies out there to help road-based surveyors gather accurate localisation data in a range of environments. In our experience, a combination of MEMS GNSS/INS technology and real-time sensor fusion gives surveyors like you the best balance of performance, price, and reliability.

OXTS has been pioneering developments in inertial navigation for over 25 years, and are now leading the way in real-time sensor fusion. Throughout, our aim has been to help people like you push the boundaries of what's possible with georeferencing technology, without introducing unnecessary complexity or cost.

To learn more about what OXTS can offer road-based surveying professionals, visit our website