

INNOVATION

How to read 6mn number plates a day

Navic has amassed a database of over 10bn licence plate reads, all of which take up 1.5PB. This can be tricky to manage.

JOANNE CAREW

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Navic reads millions of number plates every day throughout the country. Storage is a challenge.

Navic, a contraction of National Vehicle Intelligence Cloud, uses a network of around 4 000 static and mobile cameras across South Africa, equipped with automatic number plate recognition (ANPR) technology and optical character recognition (OCR) to read vehicle number plates. “Owning cameras is not our primary focus; we’re a Platform-as-a-Service business,” says Iwan Campher, the company’s CFO. “We supply the technology that delivers the intelligence by leveraging computer vision and OCR, AI and machine learning, and realtime data processing and analytics.”

Most of the ANPR cameras Navic uses are owned by private security companies, neighbourhood watches, ordinary citizens, farm watches, community policing forums, schools, and commercial businesses, like shopping malls and petrol stations. Some are also owned by government entities and municipalities. These cameras share footage using whatever internet connectivity is the best for the area and installation. Where there is a fibre connection, Navic uses it; alternatively, the cameras run off cellphone networks.

If a vehicle was recently reported stolen or flagged as suspicious because it was linked to, or involved in, a crime, a Navic user can capture and load the details onto the company’s system. Approved Navic users include members of the SAPS, and private and public security organisations, such as neighbourhood watch and farm watch groups. The system is also used by car dealers, insurance firms and courier companies. When a licence plate triggers a camera, an alert is sent to the Navic control room, where operators verify and then send alerts by Telegram, email or WhatsApp.

The process is largely automated, with human intervention focused on ensuring the accuracy of alerts, says Jaco van Wyk, director and head of compliance at Navic. “Only relevant, verified alerts are distributed,” he says. For example, Navic received 204 374 alerts in June 2024, but only escalated and actioned 170 646 of these, so that misreads and plates that have been cleared aren’t escalated for action.

Navic never deletes its data, which means that since launching in 2017, it’s amassed a database of over 10bn immutable licence plate reads, which means that they can’t be edited. It now has about 1.5PB worth of images. On the day of my interview with the company, it had already captured 3.1 million data records, and it was only lunchtime.

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- Dion Truter, Navic

Dion Truter, Navic’s joint CTO, says the company pays attention to security and privacy because it is dealing with sensitive data. He says not just anyone can access the company’s data, and access is limited to vetted users. “Every action on the system is logged, and users must provide a reason for each search or action. We have a paper trail against all user actions on the site, in perpetuity, to keep tabs on anyone who might be using the system for the wrong reasons,” he says.

It uses Cloudflare as a reverse proxy, which anonymises Navic’s cloud. “All you see from the outside is a Cloudflare IP address, which means that you can’t really tell where Navic is; it’s completely hidden,” Truter says. From Cloudflare, the data is fed into AWS application load balancers.



Dion Truter, Navic

As the company grew and the amount of data it generated exploded, it started experiencing performance issues. Network speed slowed to a crawl, and vehicle lookups were too slow, which led it to move to AWS through Vodacom Business. To manage the scale of incoming information, Navic uses AWS application load balancers to route traffic across other resources to prevent any single server

from becoming overloaded and to ensure high availability and reliability. It also uses an API Cluster built using Nginx and FastAPI, Amazon's EFS file storage, Amazon S3 with Intelligent-Tiering, Redis in-memory storage, and a PostgreSQL object-relational database system. "When a read comes in, we need to be able to dump that data as quickly as possible so that we can make space for the next request that comes in," says Truter. He says Amazon's EFS is a good fit because it's so fast and shareable. This is important because the information can be made available on the Navic admin portal and shared with the alert room immediately.

Because lives may be at stake, the process of capturing the image through to the alert being sent out takes around a second. This means that if a police officer with a mobile camera happens to be driving behind a car that has been reported stolen, they'll get an alert about that car in realtime and can act before the criminal can escape, says Truter. The admin portal also needs to handle searches conducted by users, whether they're members of a neighbourhood watch, police investigators, or people responding to alerts. "We had to do some pretty clever data partitioning to handle the competition between storing and searching," says Truter. It has a small and fast database that isn't resource-intensive for active crime fighting and response, he says.

Interest in a stolen vehicle is highest on the day it is stolen and then wanes over time, he says. This is why Navic's data needs to be available in real-time, but as time passes, it becomes less and less relevant.

The company has multiple storage tiers so that users can go back in time to find research and archive data. "If someone was murdered on Newlands Avenue in Cape Town at 10pm on June 10 2022, and a witness recalls seeing a man in a Nike T-shirt fleeing the scene in a blue Mazda, but only managed to catch part of the number plate, Navic's technology can be used by the police doing the investigation to verify this account," says Truter. Navic could pull up information from that area on that day, search for the word "Nike" using cameras in the vicinity to try to get a better look at the suspect, and even attempt to find the vehicle by searching for the car's colour and the partial number plate.

Truter says it focuses on number plates, not individuals. "While some of our images obviously have people in them, as with all our data, access can only be given with the relevant legal permissions. For instance, insurance companies may want to know if the registered owner was driving at the time of an incident. Data can then be shared, but only with the written consent of the vehicle

owner,” he says. All inquiries must be crime-related, and only trained members have access.

This research and archived data also posed some storage challenges, says Truter. “We initially moved all older images on a trickle-feed basis from Amazon EFS to Amazon S3. But we started experiencing performance issues and quickly realised that having a large volume of files gets really expensive.” He says it found out that its storage costs skyrocketed based on how many files it put in, not necessarily how big they are. To solve this, it uses tar (tape archive) files, which combines files and directories into a single file, without them having to be compressed. “We glue files sequentially together, back to back, into one big, globular file to make storage more cost-effective,” says Truter. “Considering that we have 4 000 cameras, our strategy was to compile all the images from every hour, for every camera, into one large file. So instead of having one million images an hour that we need to store, we now only have 4 000 files,” he says.

It uses AWS S3 buckets for its standard storage; older images are stored in Glacier Instant Retrieval. Images older than two years are moved to Glacier Deep Archive. With the deluge of images and records, Truter says it’s a process of constant optimisation.

“Data partitioning has been critical to helping us scale the way we have and get to where we are today,” he says. “But we’re always trying to be proactive and look at what else is out there so that we can find the best tools and technologies to support the work we do.”

CIO DIRECTORY 2025

I'm a huge fan of science fiction. It's a passion passed down from my mother, who was an enthusiastic reader of the two greats, Arthur C. Clarke and Isaac Asimov. These two were real visionaries.

CISO DIRECTORY 2025

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BRAINSTORM September 2025

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