PREVENTING LOSS, SECURING ASSETS

Millimeterwave screening for loss prevention

White paper | Version 01.00 | Andreas Hägele, Dr. Christoph Baur, Peter Walhöfer

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AT A GLANCE

- Loss prevention: avoiding inventory shrinkage, sabotage, financial losses, legal penalties, reputation damage and loss of customer trust
- The best approach to loss prevention: combining qualified security staff and AI based millimeterwave security screening to identify concealed items – sustainable, fast, convenient and safe
- Rohde&Schwarz: our mission is to help you protect your assets

Despite advancements in security technologies across nearly every industry, use case and screening operation, people screening options have largely remained the same for more than a decade.

People screening for loss prevention, employee screening, data center security, high-value manufacturing, event security and other applications rely upon insufficient metal detection systems and personnel-intensive measures like physical inspections and pat-downs. Other imaging systems and screening technologies rely on terahertz imaging, which lacks sufficient resolution to detect items of interest, sacrifice personal privacy, and suffer from slow, operator-dependent procedures, limited performance and privacy concerns. X-ray screening gives rise to severe reservations with employees and operators due to its ionizing radiation. The performance challenges and staffing requirements of these legacy people screening technologies have consistently undercut the business cases for making investments to procure and operate state-of-the-art systems.

Rohde&Schwarz provides security solutions for a wide array of businesses and organizations ensuring loss prevention and peace of mind with its R&S®QPS product family, which includes the R&S®QPS201 and R&S®QPS Walk2000 security scanners, both of which use millimeterwave (mmWave) screening, a completely touchless, safe, comfortable and convenient security concept.

SOLVING THE PROBLEM OF LOSS PREVENTION

According to the US Chamber of Commerce, 75% of employees steal from their workplace. A 2020 report by the Association of Fraud Examiners said that the average loss resulting from asset misappropriation at a warehouse or inventory department is USD 85000. Meanwhile, a report by IBM® Cognos® Analytics stated that the frequency of incidents of theft per company has increased from 1% in 2016 to an average of 3.2% in 2019.

The so-called "10-10-80 Rule" says that ten percent of employees will never steal from their employer, 10% will do whenever possible and 80% can be motivated to steal if it is easy and personal risks are estimated to be as low as possible. Worryingly, 82% of security teams in companies or organizations are under-staffed. This can mean security staff are working extra hours and getting tired, heightening the risk of failure. Therefore, a combination of trained security staff and state-of-the-art AI based screening technology is the most promising approach towards loss prevention, deterring those 80% of employees potentially prone to steal from their employer.

Loss cannot be limited to material goods only. One of the most valuable assets today is data. The loss of data or IP from data centers or sabotage by infiltrated malicious data can be expensive and detrimental to the reputation of a company. In the light of this threat and consequential damages, data centers are investing in physical security, with this market growing at a rate of over seven percent annually.

Loss typically starts from theft or sabotage. Theft is a direct loss. Sabotage is an indirect loss caused by a security breach or employee action. Dangerous goods like explosives, weapons, chemicals, drugs and other harmful substances can also be stolen for use by criminals. Equally, companies and organizations need to prevent dangerous materials or threats infiltrating their premises.

MILLIMETERWAVE SCREENING AND THE AGE OF AUTOMATED DETECTION

Security employees work long hours and can suffer fatigue as a result of conducting the same inspection and monitoring tasks over and over again. AI based security scanners do not. Meanwhile it is widely accepted that these scanners make life easier for security staff and employees. Legacy scanning technologies like metal detectors, however, are not always effective at finding hidden target objects. Standard walk-through metal detector arches like those at airports cannot detect non-metallic objects. Other techniques like manual frisking by security staff may be challenging due to gender or cultural/religious sensitivities and high staff costs. Respecting privacy is also an important aspect to be considered, and the COVID-19 pandemic has underscored concerns about body contact. Furthermore, manual frisking routines always bear the risk that one or more parts of the body where objects could be hidden remain unchecked.

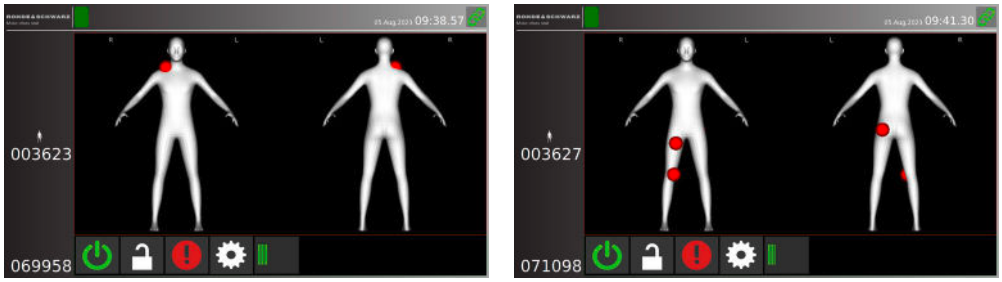
Artificial intelligence based millimeterwave (mmWave) screening is a completely touch-less security approach. To date, this technology has developed into the de facto standard for modern airport passenger security screening. It detects any kind of dangerous objects or substances concealed under clothing. mmWave screening is safe, comfortable and convenient for the person and also the security staff.

Unlike conventional security scanners, millimeterwave imaging detects metallic and non-metallic objects. This includes solids and liquids as well as weapons and dangerous materials like explosives, drugs, currency, jewelry and electronics, small devices like USB sticks and SD cards. Even organic materials like meat and vegetables can be detected. It is this combination of millimeterwave imaging and AI which makes the mmWave scanners so powerful.

Millimeterwaves are very good at depicting objects in detail. They are completely reflected by the skin and the power levels used by mmWave security scanners are even much lower than standard Wi-Fi routers, Bluetooth® devices and cell phones. mmWave radiation is non-ionizing and has a very low power density, unlike ionizing radiation like X-rays that can penetrate the human body and potentially harm cells. This means they are safe to use and do not cause cancer or other health problems. This makes millimeterwaves absolutely safe to use for everyone including pregnant women and people wearing medical devices as well as for the operating staff.

While they cannot penetrate skin, mmWaves penetrate clothing before they are totally reflected by the body. This makes hidden objects in between visible. Put simply, AI software in the scanner analyzes these signal reflections. Thus, the AI software will automatically detect anomalies and locate hidden objects. The location of these objects is shown to the scanner operator on a gender-neutral avatar of the person being scanned.

Millimeterwave picture shows avatar of person, and displays an alarm on avatar where asset is hidden

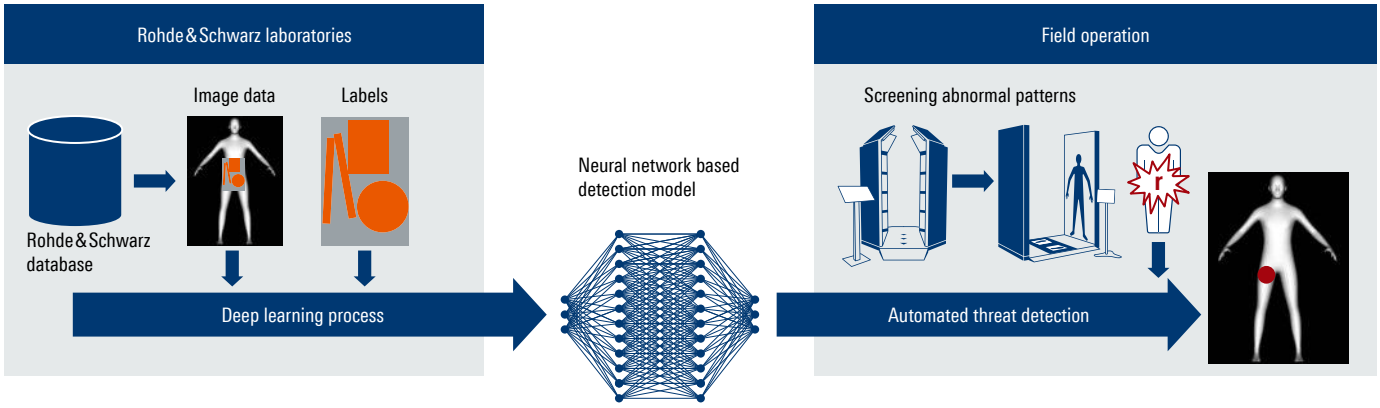


ARTIFICIAL INTELLIGENCE IMPROVES SECURITY EFFECTIVENESS AND OPERATIONAL EFFICIENCY

Prior to the implementation of AI based, automated detection algorithms on imaging systems, detection performance was limited to the skill and ability of the human eye to spot anomalies and threats. Recent developments in AI and deep learning have enabled even more effective, targeted algorithms that deliver unprecedented performance with the lowest false alarm rates.

Rohde&Schwarz AI scanner software uses neural networks, a mathematical model that mimics the human brain. This enables the software to "learn" to detect objects during a training process performed in Rohde&Schwarz laboratories. The software is trained both with and without objects. Labels are used to show where a target object is placed in a particular image. This tells the neural network what an anomaly caused by the object of interest looks like, and what the scanner needs to focus on. Once the neural network is trained sufficiently, the detection algorithm is frozen. It is then combined with the scanner's other software, ready for use in the field.

Schematic overview of R&S®QPS deep learning processes in Rohde&Schwarz labs and automated threat detection (ATD) in field operation



AI software is very powerful. A single scan generates two billion readings, which are then analyzed by AI in real time. AI also allows a high degree of flexibility as the software can also be trained with detection capabilities for specific operational scenarios, e.g. to detect food, data-bearing devices or pharmaceutical products. The more training data the neural network receives and the better the quality of this training data is, the better the software will be at its task. Rohde&Schwarz benefits from having a gigantic database of objects made from all kinds of materials in all shapes and sizes. The company's database is constantly growing, with the data stored locally in a secure vault.

ADDRESSING NEW CHALLENGES

The challenges of people screening in applications like loss prevention and asset protection are just as daunting because security operators are tasked with detecting a wide range of targets, from secret prototype materials and high-value manufactured parts made of glass or plastics through to packages of pharmaceuticals and expensive cosmetics.

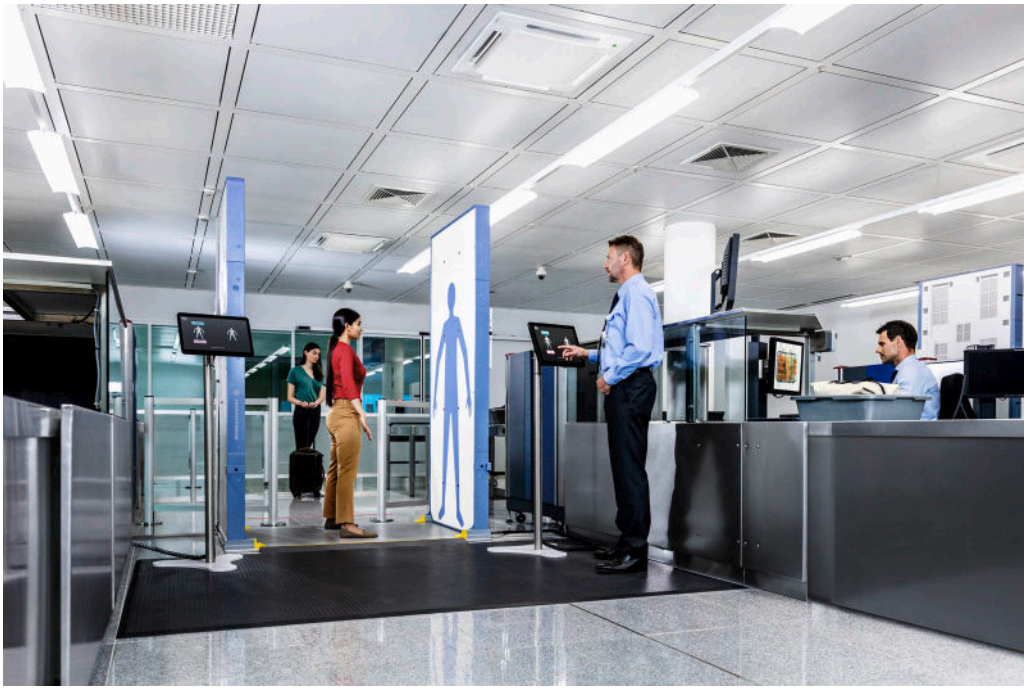
To address this challenge, machine learning is one approach that has been effectively used to develop enhanced and specialized algorithms. Combining deep learning techniques coupled with deep learning databases of items of interest means that rapid development of detection algorithms can be optimized for very specific use cases and detection challenges. These range from target object-optimized detection algorithms to application-specific optimization of screening procedures, such as the effective screening of people in various clothing types, or screening while wearing a face mask. Such application-specific and application-optimized detection algorithms have been developed/deployed e.g. for detecting narcotics in correctional institutions or other contraband in border control applications or to enable the reliable detection of data-bearing devices at data centers.

MILLIMETERWAVE IMAGING QUICK PERSONNEL SECURITY SCANNERS REVOLUTIONIZING SCREENING

The R&S®QPS family includes two solutions: the R&S®QPS201 and R&S®QPS Walk2000.

The R&S®QPS201 is a static millimeterwave imaging security scanner, familiar to most people from airport installations. Persons step inside the R&S®QPS201 and assume a comfortable standing position while they are scanned. The scan is then analyzed, and the results are displayed on a gender-neutral avatar. The R&S®QPS201 provides very high precision and is able to detect even tiny objects. A person is fully screened in 1.5 seconds. The technology is trusted and certified throughout the aviation industry with over 1000 scanners successfully in service at airports worldwide.

The static, high-precision R&S®QPS201 mmWave scanner



The R&S®QPS Walk2000 is the first-of-its-kind walk-through mmWave scanner for fast, contactless, full-body screening in high-footfall areas. The scanner has two advantages: persons do not need to remove their outer garments like coats or jackets, and they can pass through the scanner at walking speed without having to "pause and pose".

The R&S®QPS Walk2000 is designed to process up to 750 people per hour and thus ideally suited for fast crowd processing, e.g. employee screening during shift changes at a distribution center.

The walk-through, high-footfall R&S®QPS Walk2000 mmWave scanner

USE CASES

Several real-life use cases illustrate the contribution made by mmWave security screening. Theft at meat factories for example can be a problem with employees taking meat from work. Metal detection cannot detect stolen meat products on a person and manual frisking takes time and is prone to human error and discomfort. The R&S®QPS Walk2000 has proven to be the ideal solution for this scenario and particularly the low false alarm rate and high walk-through screening rate help minimize queuing time at the factory exit. It is also worth mentioning that the presence of the scanner also acts as a deterrent to would-be thieves.

Rohde&Schwarz also supports the German cosmetics distributor and retailer Flaconi. Cosmetics can be physically small, but high in value, some of which easily exceed several hundred euros. As with stolen meat, metal detection will not work for these products, which are usually packed in glass or plastic. As in other workplaces, manual frisking can cause queues and high security staff costs. The R&S®QPS was therefore once again identified as the best screening solution. For this application, the scanner software was specifically trained to detect cosmetics with a low false alarm rate. Due to its speed, comfort, safety and touchless, precise screening process, the R&S®QPS is highly appreciated and accepted by the employees as well by the security staff.

Another interesting example is the use of mmWave scanning to detect stolen Blu-ray™ disks that contain major film or video game releases. Companies distributing Blu-ray™ disks may face severe penalties if disks appear on the market before they are formally launched. As with cosmetics and meat, metal detectors cannot detect Blu-ray™ disks. To compound matters, their flat shape makes them easy to hide, which makes it hard to discover them during manual frisking routines.

Similar problems can be experienced at data centers, which can suffer theft of sensitive data on small devices like USB sticks or SD cards. These data centers can also be at risk of someone taking a computer virus into the data center or carrying out a cyberattack from within. Unlike other workplaces, very few people tend to visit the server rooms of data centers each day. However, the centers need permanent security in place as they are in operation 365/24/7, resulting in significant security staff resources and costs. Rohde&Schwarz helps to secure data centers with the R&S®QPS201 scanner, which acts as the core element of a checkpoint remote screening solution developed by leading security provider SECURITAS AB. This remote screening solution combines the efficiency of high-tech scanning and video technology with mobile and remote guarding to form a highly efficient and effective approach to checkpoint security and data center asset protection. A person enters the checkpoint area, empties his or her pockets under remote CCTV observation and is remotely screened by the scanner. The guard at the remote operation center verifies the scan. Only a "clean" scan will permit access to the facility. In case a foreign object is detected, a mobile guard is instructed to resolve the issue at the checkpoint. A single remote guard at the operation center can supervise several checkpoints. The extremely low maintenance requirements and low false alarm rate of the R&S®QPS scanner make this remote checkpoint concept a sustainable, cost-effective security solution.

Needless to say, the remote checkpoint solution can easily be adapted to other loss prevention and security applications.

Rohde&Schwarz also works with the Swiss Army to secure ammunition depots. There is an understandable imperative to safeguard these facilities against theft of munitions, weapons and explosives. Ammunition can be very small and difficult to detect. The R&S®QPS201 provides an airport-like security checkpoint surveying people entering and exiting the ammunition depot, while the application-specific detection software even exceeds the requirements of aviation security.

ENGAGEMENT MODELS

Rohde&Schwarz works with specialist companies in the field of physical security and loss prevention that provide holistic solutions. You will rarely find an mmWave scanner deployed on its own at a security installation. Scanners are typically paired with other technologies to enhance screening, such as X-ray baggage scanners or automated access control solutions. Both the R&S®QPS201 and R&S®QPS Walk2000 can easily be integrated into a complete security lane architecture or an even more holistic, integrated security solution.

CONCLUSIONS

Financial loss and consequential damage through theft is a major problem for businesses and organizations. Legacy screening systems like metal detection have shortcomings reducing their effectiveness. Manual frisking is highly inefficient, slow and burdened with a lack of privacy and distance. Millimeterwave scanning is a safe, non-intrusive technology detecting all types of objects and materials concealed on a person. R&S®QPS201 and R&S®QPS Walk2000 mmWave scanners are trusted by users around the world. Their adoption in a range of industries from food production to cosmetics, Blue-ray™ disk distribution, data centers, technology companies and the armed forces is testament to this. Taking a holistic approach, Rohde&Schwarz provides security solutions using mmWave scanners for a wide array of businesses and organizations, ensuring peace of mind when it comes to loss prevention and asset protection.

Rohde & Schwarz

The Rohde & Schwarz technology group is among the trailblazers when it comes to paving the way for a safer and connected world with its leading solutions in test & measurement, technology systems and networks & cybersecurity. Founded more than 85 years ago, the group is a reliable partner for industry and government customers around the globe. The independent company is headquartered in Munich, Germany and has an extensive sales and service network with locations in more than 70 countries.

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Preventing loss, securing assets
Data without tolerance limits is not binding | Subject to change

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