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Introduction

A connected city with public safety at its centre

The Internet of Things for Public Safety and Security is a key element of safe and secure city infrastructures. Its power can also be harnessed for Protection and Disaster Response (PPDR), particularly when sensors, local and mobile IoT networks, services, applications and big data analytics are effectively employed to ensure dynamic awareness of environments in real-time.

Benefits of smarter PPDR include enhanced decision making for rapid assignment and mobilisation of appropriate resources for resolving threats and effectively managing incidents. Perhaps the greater value of IoT for Public Safety is the new provision of data insights to prevent potential disasters.

Plextek has employed effective IoT solutions to massively increase public safety and security, and we have been able to demonstrate how these are being used for more agile, dynamic and accountable PPDR.

Indeed, we have successfully deployed a wide range of operational IoT solutions for this purpose and this brochure details just a few examples of the dozens of projects that the company has carried out in such critical areas.

– Nicholas Koiza, Head of Security Business
The Threat
Dense and congested urban cities put a tremendous strain on power and energy infrastructures. As a result, hundreds of service manholes and access points catch fire or explode every year.

These manhole explosions can occur when underground electrical wires are damaged, causing sparks that can ignite surrounding gases and electrify manhole plates. Primarily caused by bad weather and flooding interacting with aging power infrastructures, these incidents can be fatal to pedestrians.

To protect the public from these risks, IoT sensor company, CNIguard, wanted a system that could detect and transmit early warnings about sites before reaching critical state so preventative action could be taken.

Our Approach
Plextek supported the design and manufacturing of a sensor array capable of operating in this harsh environment. This included a novel power harvesting input to extend the sensor lifespan using locally available free energy sources. To enable the client to quickly deploy the product into the market, we worked to a reduced timescale in delivering a fully functioning working system and software interface.

The Outcome
Our solution prevents and mitigates the risk of gas explosions, stray voltage, flooding and other breaches of safety, environmental and quality control regulation. Positively received by our client, the system is currently installed and saving lives with Plextek now working to refine the design for further high volume production.
Foreign Object Detection for Airport Runways

The Threat
Detection of Foreign Object Debris, commonly known as FOD, is an important public safety, security and quality control in any aviation environment. Small debris, loose objects and wildlife on the runway, if left unchecked, has the potential to cause damage to airport equipment and delays to runway operation. The worst case scenario of FOD occurred in 2000. During take-off, Air France Flight 4590 sucked up debris causing subsequent engine failure resulting in the loss of all 109 people on board.

Wave Tech, a Korean-based RF signal technology company, had a vision for a short-range Foreign Object Detection system. Intended to be a low size, weight and power (SWaP) solution, the system could be easily deployed into the market without compromising high accuracy performance.

Our Approach
Our recent experience in millimetre-wave radar enabled us to produce a dual fixed and mobile solution capable of detecting objects and movements from a fixed radar range of 400m. The mobile system delivered was designed to be mounted onto the roof of a vehicle to scan the runway while moving.

For enhanced situational awareness, the solution also implemented advanced signal processing algorithms to discriminate between wanted and unwanted signals and to separate the detection of targets in close proximity to each other.

The Outcome
Our mm-wave radar solution was able to deliver 100% target detection results in early-stage development tests, displaying accuracy and detection equivalent to a single fixed antenna. The radar is now currently installed at Incheon Airport, Korea, and is producing highly accurate results.
Smart City Street Lighting Infrastructure

The Threat
The monitoring and control of street lights has become the backbone of public safety within both cities and rural areas. Improved street lighting can prevent and deter criminal activity at night, illuminate routes for emergency services and increase informal surveillance within residential areas.

Initially driven by the need to save energy and reduce costs, smart street lighting has also become the ubiquitous hub through which all manner of urban data feeds are collated.

Telensa’s PLANet, a world leading lighting control system, is deployed on 1.5 million lights around the world and required our expertise to develop the technology with a license-free radio system.

Our Approach
To deliver a license free-radio system, Plextek created a custom Ultra Narrow Band (UNB) radio protocol, capable of ranges over 16km with a single base station cable connecting up to 5000 sensor nodes. This allows communication between hundreds of thousands of nodes over citywide areas.

The monitoring and control in this system involved sensing the voltage and current in the lamp unit and deriving the power factor, the prime indication of the health of the lamp. This information is then transmitted to the base station that then sends commands to the street lights to either switch or dim.

Outcome
Our UNB Low Power Wide Area (LPWA) technology has been tried and tested in live global deployments for over a decade now, successfully helping Telensa build their position as a Smart City Market Leader.

Acting as Telensa’s design authority, Plextek continue to support the technology through adding new features and product variants to meet changing market needs. Telensa have now taken the lead in providing cities with a range of urban data and sensing solutions, with Plextek providing technical services to facilitate these bold new Smart City products and services.
Stolen vehicle tracking and driver behaviour monitoring

The Threat
Over the past few years, vehicle theft has risen due to ease of access to computerised unlocking technology that exploits keyless vehicles.

A new insurance claim is made in the UK every 6 minutes, mainly due to vehicle theft leading to property damage and dangerous driving.

This has pushed a rapid growth in telematic ‘black boxes’ and smartphones for locating stolen vehicles and assessing insurance premiums based on the driver behaviour.

A governmental client in the security space set Plextek the challenge of determining the extent to which a vehicle could be reported stolen based on whether an individual driver could be identified just from the data that is accessible from the vehicle’s on-board sensors.

Our approach
During the project, we gathered telematics data for a large number of journeys, with a range of drivers, all driving the same vehicle. We identified a number of quantifiable metrics of driving style, and then used a statistical analysis of the background data set to profile each driver. Driver metrics collected from subsequent test journeys by each driver were then compared with the baseline metrics to assess correlation. The result was an effective method of identifying individual drivers where the only information available is from a vehicle’s black box sensors or the driver’s smartphone sensors.

The Outcome
Plextek developed an end-to-end solution for Redtail, now a global leader in the design, manufacture and distribution of telematics products and services.

Their powerful data analytics have processed over a billion miles-worth of data and their design and manufacturing teams have delivered over 5.5 million devices into the worldwide automotive aftermarket.

In addition to security applications, such as vehicle theft, uses also include differentiating between drivers for young driver car insurance and distinguishing between drivers of shared commercial vehicles.
Testing and Validating Connected and Autonomous Vehicles

The Threat
Autonomous vehicles must be capable of sensing their environment, including moving objects and people, so that they can move safely with little to no human input. In pursuit of achieving the next level of vehicle autonomy, Plextek has been assisting Cranfield University in its HumanDrive Connected and Autonomous Vehicle project. The aim of which is to test and validate the full autonomy of a vehicle as it completes an end-to-end journey.

Our Approach
The vehicles were tested on a prepared strip of road for their ability to safely operate in a variety of conditions, including in an environment with many moving and static objects and in a variety of weather-led conditions. Fully autonomous, the vehicles are capable of completing a lengthy end-to-end journey in a variety of settings, including country roads, A-roads and motorways.

The Outcome
Plextek is proud to provide Cranfield University with 12 electronic-scanning radars capable of detecting and tracking moving people, vehicles and unmanned aerial systems. Compact and low in power consumption, our radars are designed to be spaced along the road and will detect and localise vehicles and people up to a distance of 120 metres. These radars have been successfully installed along Cranfield’s test road and are currently helping the university further understand the capabilities of autonomous vehicles.
Smarter Counting of People in Crowded Environments

The Threat
Accurately counting the number of people boarding and disembarking public transport vehicles, such as trains or buses, for safety or ticketing purposes is a perennial problem. Current systems commonly use cameras, but it is acknowledged that these can be inaccurate as machine-based image processing finds it hard to distinguish individuals from pairs or groups of individuals, particularly in poor light or when cameras cannot be placed in optimal locations.

A multinational electronics company asked Plextek to find a more reliable, Smart Sensing method of counting people that requires no human intervention.

Our Approach
The work involved finding the optimum sensing technologies and determining how the outputs could be fused in order to overcome the limitations of any single sensing technique. Optical, acoustic, radio and thermal techniques were all considered separately and in combination, together with a range of signal processing approaches.

Outcome
Plextek’s final solution involved two rows of sensors (to detect direction of passenger travel) built into the vehicle doorway. A combination of infrared and ultrasonic sensing was employed, with a sophisticated algorithm amalgamating the output of the two sensors and rejecting false triggering.

Accuracy was measured for a range of typical scenarios involving multiple passengers transiting the doorway, with performance exceeding the design targets.

The technique has a number of other potential people counting applications in safety, healthcare and security.
About Plextek

**We have a 30 year history of providing secure critical communication solutions to global organisations.**

Plextek can address the global public safety market’s need to be quicker, smarter and more efficient in keeping citizens safe in times of crisis.

We understand today’s key security challenges in critical communications and can generate both the ideas and deliverable solutions to the assured level of security, performance, resilience and ergonomics that you need.

We are a product development company that works with clients to achieve results based on their specific requirements and our engineering experience, supported by our library of IP for key technology elements aiding accelerated time to market and greater cost effectiveness.

About Nick Koiza

**Nick’s focus at Plextek is solely on helping organisations in the public safety mission critical communications and security sectors with their strategic positioning and technological capability.**

Nick has a long and successful track record across public safety, security and mission critical communications, having held senior management positions in public and private companies spanning IT, technology and communications.

Prior to joining Plextek, Nick worked at Sepura Plc, Portalify Oy and Simoco Group, where he developed a strong reputation as a leading authority in secure critical communications.

For more information on how we can develop this technology for your security business needs, please call.

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