

## About Plextek

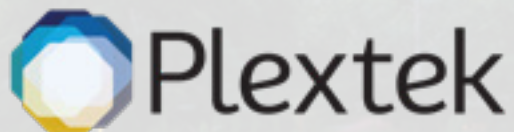
We have a 30 year history of providing technology solutions to a variety of organisations. Plextek understands today's key challenges for smarter technology development and can generate both the ideas and deliverable solutions to the assured level of security, performance, resilience and ergonomics that you need. We are a product development company that works with clients to achieve results based on their specific requirements. Our engineering experience, supported by our library of IP for key technology elements, aids accelerated time to market and greater cost effectiveness.

## About Shahzad Nadeem

Shahzad is the Head of Smart Cities Business at Plextek. He has extensive international experience of working in the telecoms market and his focus is delivering business value by utilising technology innovations. The development of a major IoT connectivity platform is one of Shahzad's recent works. He specialises in smart cities, mobile networks, MNOs, MVNOS, MVNEs, wholesale, m2m and IoT and has a keen interest in both technical and commercial aspects. Working cross functionally with businesses, customers, technology, marketing and suppliers, he has delivered complex solutions in the mobile networks and IoT industry.



Get in touch to find out how Plextek can develop this technology for you.



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# IoT for SMART CITIES

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## Introduction

**The Internet of Things is the bedrock of smart, connected and secure cities. A network of sensing and communication technologies enables the collection and analysis of data, making life easier and more efficient for everyone.**

Plextek has developed hundreds of solutions in the sensing, communications and analytics areas for clients, enabling various applications in smart cities. Some of our solutions have now become market leading spin-out companies providing critical infrastructure monitoring, connected street lighting, vehicle telemetry and airborne, unmanned vehicles detect and avoid applications.

The majority of smart city applications require careful consideration. The low cost, off-the-shelf sensing solutions may deal with the low TRLs (Technology Readiness Levels), but when it comes to higher TRLs and reliable solutions that are future proof, there are issues of cost, power consumption, functionality, compatibility, security, scalability and robustness. Bespoke, future proof designs offer long term protection of market credibility and revenues.

Plextek has developed market leading, scalable solutions for organisations in defence, healthcare, smart cities and industrial automation. We develop your ideas into products delivering best-in-class engineering solutions.

*Shahzad Nadeem, Head of Smart Cities, Plextek.*

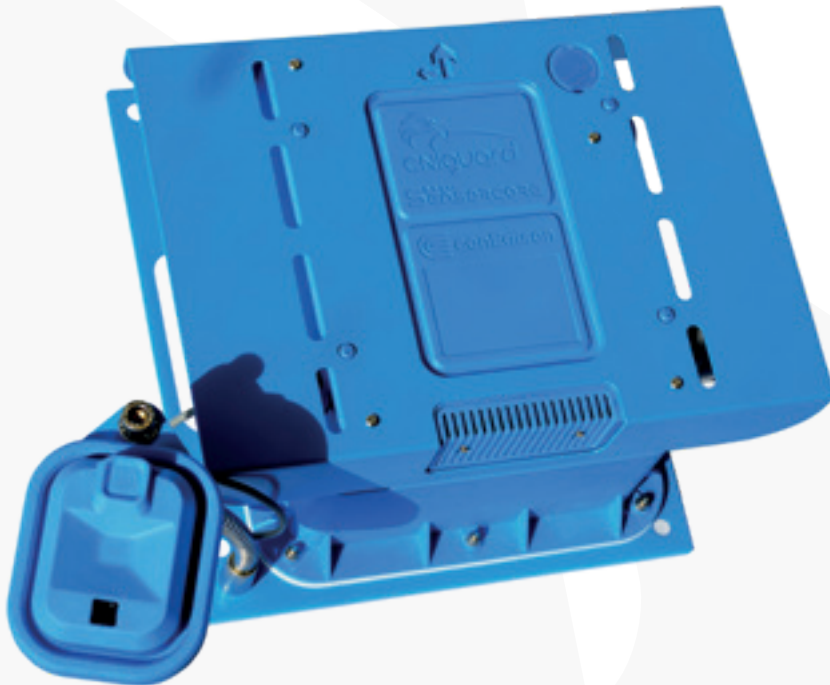
# Sensor Monitoring of Manhole Infrastructures

## The Challenge

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, CNI Guard, 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 harsh environments. 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 Impact

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.



# Smart City Street Lighting Infrastructure

## The Challenge

The monitoring and control of street lights has become the backbone of public safety and energy efficiency 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 a 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.

## The Impact

Our UNB Low Power Wide Area (LPWA) technology has been tried and tested in live global deployments for more than a decade now, successfully helping Telensa build their position as a smart city market leader.

Acting as Telensa's design authority, Plextek continues 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.

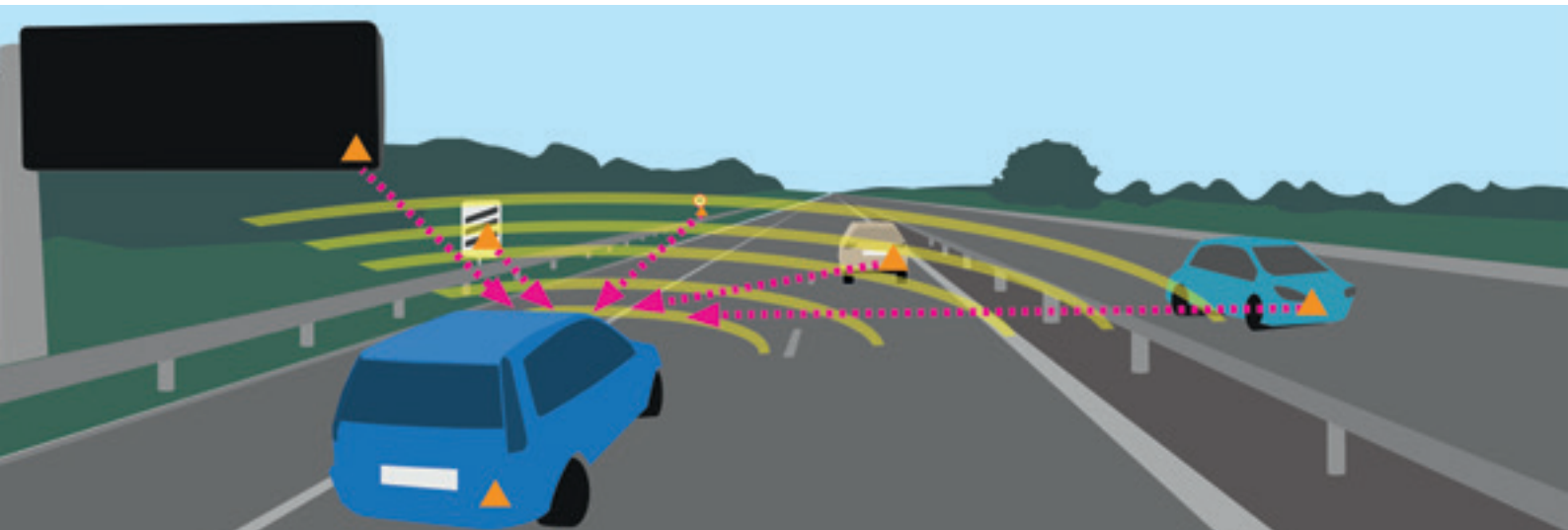
# Passive Radar Identification Tag for Unambiguous Object Localisation

## The Challenge

Practical object and vehicle recognition in intelligent and autonomous transport systems remains a data-first problem. The more unique data that is captured and identified, the more accurate the decisioning models can be. As part of the Department for Transport's Transport Technology Research Innovation Grant (T-TRIG), Plextek have developed a low size, low weight and power tagging system which can bounce back a unique radar signal in order to provide exact object and vehicle localisation and recognition.

## Our Approach

Plextek has successfully developed a low-cost proof of concept demonstrator. This retroreflector ID tag has been tested at two typical ranges for its application, 30m – 60m, with successful results. Implementing a radar system with optimised power and ramp waveforms will enable the tagging system to continue to work at longer ranges.



## The Impact

The retroreflector ID tag acts as a high visibility jacket for high frequency signals and extends the capability of standard automotive radars. In the smart city, this tag will benefit the recognition of road signage and infrastructure, other road vehicles and support for autonomous convoy operation.

In addition, the tagging system enables identification of drones, small aircraft and the monitoring of small craft at sea in poor weather conditions. Plextek is currently mapping out a route for commercialisation in the automotive sector where low-product cost and optimised detection range will be paramount.



# Smarter Counting of People in Crowded Environments

## The Challenge

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.

## The Impact

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.

# Smart Utility Meters

## The Challenge

Reporting usage statistics for billing is just the tip of the iceberg. Smart meters provide communications between individual properties and the nationwide utility networks – facilitating a broad range of functionalities. This project's aim was to provide a smart meter communications infrastructure with reliable nationwide coverage. The second generation smart meters operate over two radio systems: a cellular system covering the south and centre of the UK and a UHF band radio system in the north.

Achieving the right coverage requires meeting challenging RF emission specifications set out by the smart meter suppliers. To tackle this issue, Plextek was contracted to independently assess the requirements, the radio link budget and the performance of different smart meters to help ensure correct system operation.

## The Approach

Plextek designed some of the very first smart meter radio deployments in the US, providing radio communications with reliable coverage in the licence-free bands. This expertise left us well placed to act as an independent technical reviewer for our client. A key output of our review was that measuring low-level emissions is close to the limits of what is possible with typical RF test configurations.

Plextek created a comprehensive test specification and established a reliable independent test facility so that the smart meter suppliers could record repeatable results against a common test regimen. The specification and testing process is subject to review by a working group comprising smart meter manufacturers, DCC and BEIS.

## The Outcome

Equipped with Plextek's measurement data, the smart meter manufacturers have the information needed to adjust their designs to meet the noise emission limits and demonstrate compliance with the system requirements.

