



Connected Autonomous Mobility



We are a product development company that supports organisations to bring highly technical products and services to market.

Plextek is heavily involved in smart road and transport solutions and have fulfilled critical needs for ensuring safety and operational proficiency within transport systems globally.

The transportation industry is experiencing extreme change, with an accelerated use of technology to achieve infrastructure, passenger, and pedestrian efficiency. We have successfully delivered solutions to a wide spectrum of requirements, for example:

- > Monitoring and assessing driver behaviour in real-time
- > Vehicle and object recognition
- > Early detection and identification of road hazards
- > Smart street parking
- > Intelligent street-light control
- > Software & signal processing



PROJECTS

Intelligent Mobility for Autonomous Vehicles



The Challenge

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 or risk. This de-risking exercise involves testing and validation using real life scenarios in a controlled environment. The health of decisions taken by the vehicles' on-board systems, with the assistance of AI, needs to be validated by external sources of information. The intelligent road infrastructure at Cranfield is a critical testbed environment. Although this was equipped with Cameras and Lidars, these external sources had limitations that needed complementary solutions to enhance the data set required for decision making.

In pursuit of achieving the next level of vehicle autonomy, Plextek assisted Cranfield with this £million+ 'HumanDrive' project for Connected and Autonomous Vehicles. The aim of which was to test and validate the full autonomy of a vehicle as it completes an end-to-end journey.

The Approach

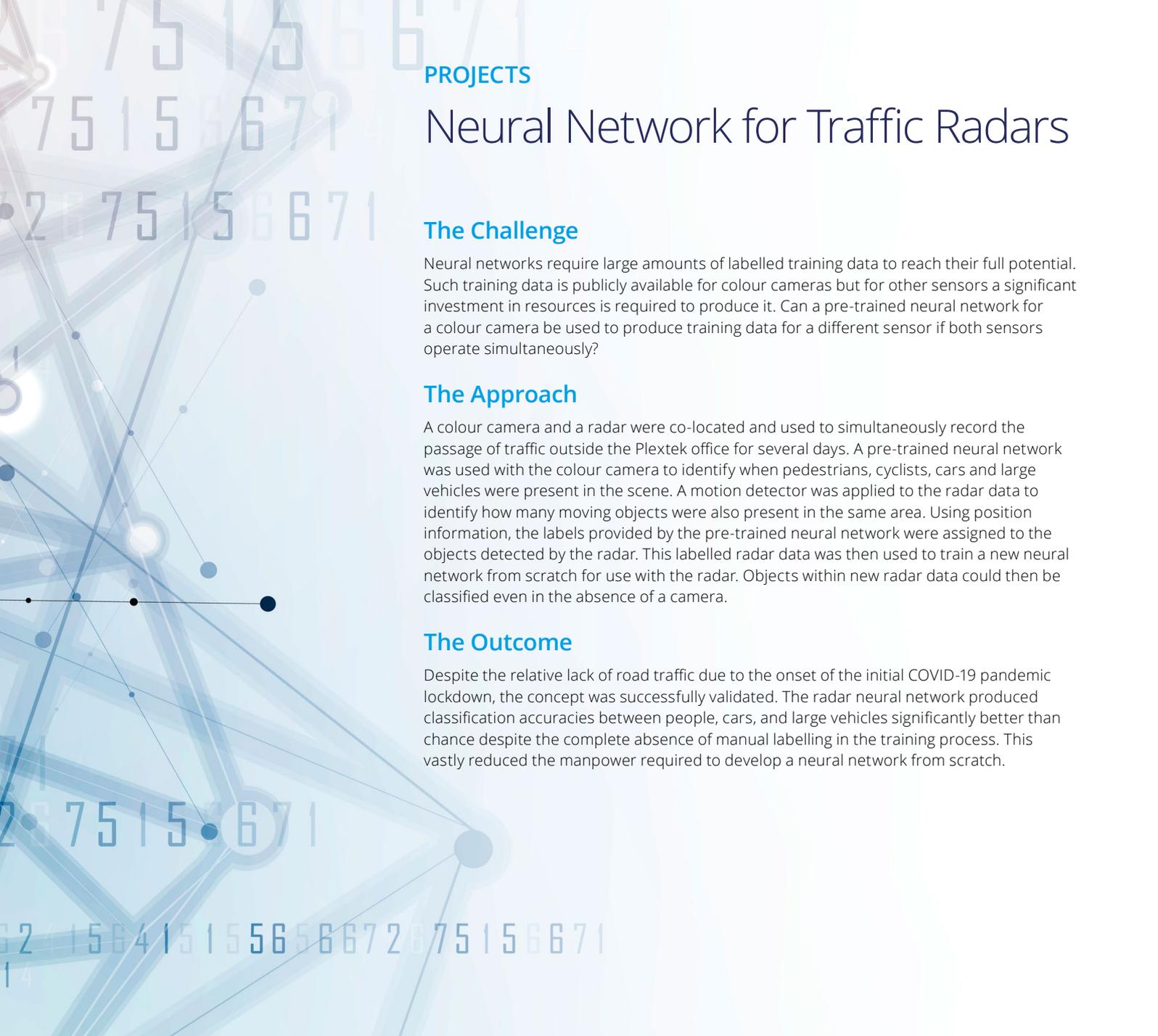
Plextek provided electronic-scanning radars to form a robust testing process for the advanced vehicle control system. Compact and low power consumption, the radars were spaced along the customer's "smart road" infrastructure to detect and localise vehicles, unmanned aerial systems and people from a range in excess of 100 metres. The vehicle control system was challenged in a variety of environments and weather conditions. Situations that would test the ability of a human driver were simulated, including densely populated sidewalks, and navigating roads with low visibility, such as rain and darkness. The data provided by radars installed on the test road was used to test and validate the decisions made by autonomous vehicles.

The Outcome

Recently, HumanDrive completed a complex real-world journey that is both driverless and human-like for other road users.

The autonomous vehicle performed a 200+ mile route across the UK through country roads, A-roads, traffic junctions and motorways.

This marked a pivotal point for the successful deployment of an autonomous vehicle solution in the UK, with Plextek at the heart of this.



PROJECTS

Neural Network for Traffic Radars

The Challenge

Neural networks require large amounts of labelled training data to reach their full potential. Such training data is publicly available for colour cameras but for other sensors a significant investment in resources is required to produce it. Can a pre-trained neural network for a colour camera be used to produce training data for a different sensor if both sensors operate simultaneously?

The Approach

A colour camera and a radar were co-located and used to simultaneously record the passage of traffic outside the Plextek office for several days. A pre-trained neural network was used with the colour camera to identify when pedestrians, cyclists, cars and large vehicles were present in the scene. A motion detector was applied to the radar data to identify how many moving objects were also present in the same area. Using position information, the labels provided by the pre-trained neural network were assigned to the objects detected by the radar. This labelled radar data was then used to train a new neural network from scratch for use with the radar. Objects within new radar data could then be classified even in the absence of a camera.

The Outcome

Despite the relative lack of road traffic due to the onset of the initial COVID-19 pandemic lockdown, the concept was successfully validated. The radar neural network produced classification accuracies between people, cars, and large vehicles significantly better than chance despite the complete absence of manual labelling in the training process. This vastly reduced the manpower required to develop a neural network from scratch.

PROJECTS

Recognition of Vehicles, Road Signage, and Infrastructure for Autonomous Transport

The Challenge

Accurately identifying, recognising, understanding, and deciphering the information from objects, vehicles and infrastructure around roads is the major challenge in V2X communications for autonomous transport. The quality of data captured determines the accuracy of decision-making models.

The Approach

Plextek developed a highly innovative low cost, size, weight and power retroreflector tagging system for the UK Department for Transport. The solution enables the accurate identification and recognition of any object around the road using 'bounce back' of radar signals. A radar system with optimized power and ramp waveforms enables the tagging system to work at ranges close to 100m.

The Outcome

The retroreflector ID tag solution verifies that it can act as a high visibility jacket for high frequency signals and extend the capability of standard automotive radars.

In a smart city landscape, this tag can recognise road signage and infrastructure, other road vehicles and support autonomous convoy operation.

In addition, the tagging system can enable the identification of drones, small aircraft and small craft at sea in poor weather conditions.

PROJECTS

Vehicle Asset Management

The Challenge

Driver behaviour profiling and accident simulation have been the major challenges for the growing vehicle insurance market. An intelligent Vehicle Asset Management (VAM) solution was required for enabling efficient management of vehicular fleets. The solution was required to incorporate TETRA and/or 4G cellular modems and GPS modules - the latter requiring antennas to function effectively - together with AI and analytics.

There is often enormous market pressure to reduce the size of such products so they can fit into a cramped location in the vehicle. This can transform the development of the antenna system from a straightforward integration of individual designs, focussed on particular frequency bands, to a highly complex custom development. Plextek began working on this technology several years ago and has since supported multiple clients in this area through our spinout business Redtail Telematics.

The Approach

The VAM solution implemented a custom designed multiband-band cellular antenna, integrated onto a PCB substrate together with a bespoke GPS antenna. The solution exceeded the performance requirements set out in the standards, resulting in a lower product cost than the equivalent COTS antennas and allowed integration into a tiny product package. Plextek was responsible for the design and manufacture of the entire Redtail Telematics range of Vehicle Asset Management (VAM) products.

In addition, sensor generated data was required to enable driver behaviour assessment and modelling, aiding road safety determination and adjustment of insurance premiums as a function of driver capability. The system was also required to provide First Notification of Loss (FNOL) with proactive real time handling of vehicle crash events. The solution developed by Plextek records GPS, accelerometer and other vehicle generated data, which are sent in real-time over wireless technologies to Plextek's Data Warehouse server platform, which in turn collates data into journeys. Analytics and AI were central to the solution delivered.



The Outcome

In 2015, Plextek Ltd formally spun out Redtail Telematics which provides turnkey vehicle telematics services, including analytics, to the fleet management and automotive insurance markets. More than six million VAM devices have been shipped into line fit and aftermarket vehicles.

The Plextek Group has expertise in working collaboratively to answer challenging questions and has directed its efforts in working with OEMs to fulfil the potential of the connected vehicle, from line fit vehicle tracking with Mercedes Benz, through golf-cart battery health with Columbia Vehicle, to pothole detection with Jaguar Land Rover & Synaptiv.

PROJECTS

Off-Road Parking System for European Cities

The Challenge

Finding a parking space in a busy urban area can be frustrating and time consuming. It is also a leading contributor to road traffic congestion, and air pollution within urban environments.

Gorizont Telecom approached Plextek to deliver the key enabling technologies for a system to detect occupancy in on-street parking spaces. Real-time data was required for notifying drivers of the available slots to enable smarter parking and alleviate congestion on roads.

The key challenges included the need for a highly accurate in-road parking sensor, citywide radio coverage and a secure back-end server with ultra-high availability.

The solution was initially required in North-Eastern Europe and due to the winter weather, the entire project had to be compressed into six months, from initial research through to city-wide deployment. As a result, our sensors would have to cope with harsh temperatures and road conditions.

The Approach

After investigating various sensing methods, a magnetometer was selected as the primary sensor. Because neighbouring vehicles, passing vehicles or parallel-parked vehicles can produce false results, we developed signal processing algorithms, threshold manipulation and self-calibration programs to achieve the very low false trigger rate specified by the client.

The sensors had no external power supply, so they were designed to operate on a low-cost internal battery with a five-year lifespan. The radio communications design was a challenge as the top of the sensor had to be flush with the road surface requiring a unique antenna created to fit around other components.

Plextek was also responsible for the design of the base station infrastructure and server that gathered the sensor data and distributed it to user facing Apps and signage.

The Outcome

The whole system was delivered and installed just before the winter freeze, allowing Gorizont Telecom to complete all acceptance criteria.

The radio design allowed a relatively sparse network of base stations to be used to save cost and the straightforward sensor deployment and calibration procedure allowed 11,000 in-road parking sensors to be deployed in two just weeks.

The technology has since been successfully re-deployed in other major cities.





PROJECTS

Creating a Competitive Advantage

The Challenge

How do you maintain a good communications link between race driver and the pit at all points around a racetrack, taking into consideration bad weather conditions and G-Force? Prior to this project there was a difficulty with black spots at particular points around the International racetracks used by Formula 1.

As one of the best-known suppliers of telemetry systems, Plextek was approached by Pi Group, the then supplier of electronic equipment to Williams and Jaguar F1 Racing, to design and produce Formula 1's first full circuit-wide lossless digital voice and telemetry system.

The Approach

First tests of the Plextek system were undertaken at the Silverstone, Hockenheim, Nürburgring and Barcelona circuits to allow models of several different environments to be produced. From the measured data, the proposed system design was developed and tested to produce coverage estimates showing the likely performance of the system. This approach allows an early check on whether the initial objectives of the system are likely to be achieved prior to the final design of the equipment.

The Outcome

The Formula 1 motor racing telemetry system developed by Plextek and Pi Group raced into first place in the San Marino Grand Prix at Imola when the Williams-BMW Team notched up the first victory of their two-year partnership.

In the gap between seasons, Pi came back to Plextek for a software upgrade program. These system improvements allowed a fully acknowledged handshake protocol. The new software also provided a data downlink channel to the car, which was previously illegal. The new Plextek software allowed the teams to receive error free transfers of data from the cars, and reliably send command information to the cars to tune performance during the race. The upgraded telemetry system was installed on four Formula 1 team cars including Williams-BMW, Jaguar and Arrows.



PROJECTS

Sensors for Automatic Passenger counting

The Challenge

Sometimes even the most capable electronics teams can benefit from a little external help.

In order to highlight and target passenger safety and security on public transport, a leading transport systems company asked us to find a better way to track passenger movements in and out of train and underground carriages. Existing methods, based on the use of ceiling-mounted cameras, suffered from poor detection rates in low light conditions. Poor camera angles on underground trains due to the limited head height available were also a problem.

Our customer wanted a solution that was highly accurate, compact and unobtrusive, and able to count multiple passengers simultaneously moving in and out of carriage doors. The system needed to overcome potentially confusing influences such as large items of luggage and passengers standing in doorways.

The Approach

Our initial work explored the reasons why existing systems were not sufficiently reliable and examined potential installation options. We concluded that a combination of ultrasonic and infrared proximity sensors, mounted at the top of the train door opening, would be the best choice. A suitable array of such sensors gave us the ability to discriminate between outward and inward movement, between humans and luggage, and to track multiple passengers simultaneously.

We then devised and experimented with detection algorithms to process the sensor data and generate passenger counts, testing at each stage using a full-size rig in our lab. Using multiple volunteers, we recreated a wide range of scenarios, evaluating and improving our algorithms at each stage.

The Outcome

We rapidly delivered a prototype design to our customer for which we had demonstrated better performance than existing camera-based solutions could achieve. We also supplied our test rig so they could perform their own evaluations and transferred of all the intellectual property, so they had ownership of the design.

Our proposed design exceeded the customer's counting accuracy target, was suitable for installation in a wide range of train and underground carriage doorways and had a low component cost.

Armed with a concept for an entirely new approach to the problem, our customer took over the development at this point, using their own highly capable electronics design and manufacturing teams. In a few short months we had been able to bring some original thinking to the problem, with a fresh perspective that helped our customer explore a wider range of routes forward.

PROJECTS

Revolutionising Car Infotainment

The Challenge

Before new sources of audio such as DAB and Spotify were widely adopted, the typical car audio system remained a simple affair with an AM/FM tuner, a CD drive and push-button control. Clarion Malaysia, a supplier of infotainment systems to automotive OEMs and the retail aftermarket, had the idea of providing an in-car system that was as powerful and feature-rich as consumers had come to expect from their portable devices.

Clarion approached Plextek to work out what performance was possible for a system like this and to subsequently design and develop this radical new product which became the Clarion AX1.

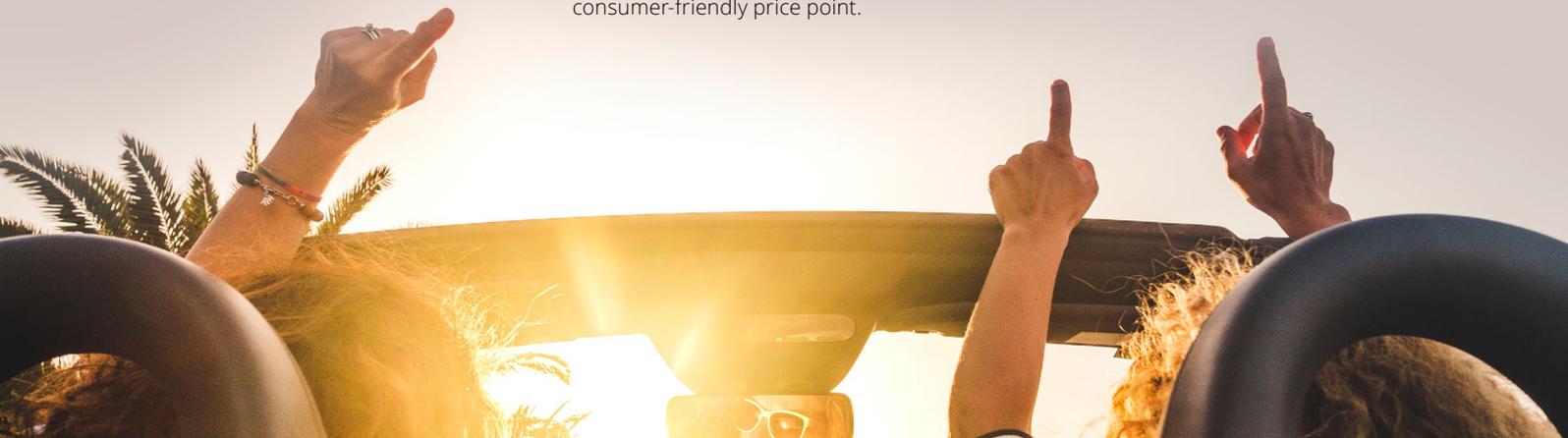
The Approach

An extensive study resulted in a specification for a touch screen device running the Android OS and supporting a range of external connectivity.

However, despite its popularity and vibrant apps marketplace, Android posed several challenges when applied to an in-car system, the biggest of which was power management. Android is not well equipped to deal with intermittent or disrupted power supplies, as happens for example when a car engine is started. Plextek addressed this by designing the AX1's processor board with several peripherals and intelligent power controls to enable the system to cope with the demands of automotive operation. Our product design and embedded software expertise was key to helping Clarion Malaysia overcome the design challenges involved in getting automotive grade reliability from the Android OS at a consumer-friendly price point.

The Outcome

The new system had a range of cutting-edge features including internet browsing, 3G support, Wi-Fi and Bluetooth audio-video streaming and an online music app store all controlled through a touchscreen interface that worked like a smartphone. The launch of AX1 generated a lot of excitement thanks to the boldness of the concept compared to the conservative designs that were typical of the category. Clarion Malaysia considers that the most important legacy of their technical leap forward with the AX1 has been cementing their reputation as an innovative market leader, and the new partnerships, relationships, and business that this brought them.



PROJECTS

Marine Tracker

The Challenge

Protection of coastal borders is increasingly necessary to help target smugglers and prevent illegal entry. ATLAS Telecom has instructed Plextek as part of their next generation E-Passport programme to deliver a highly innovative marine tracker solution serving the evolving needs of the Critical Infrastructure and Coastal Protection Authority (CICPA). ATLAS Telecom has recently awarded Plextek an initial £4.4M contract for the programme's first phase.

E-Passport advances the surveillance and reconnaissance operations for increased coastal security and safety, aided by autonomous notification of impending threats and behaviour pattern anomalies.

The Approach

Plextek's work includes the design and high-volume manufacture of a critical element of the end-to-end E-Passport solution; consisting of an advanced military grade hybrid TETRA-LTE GPS smart tracker device that provides life-saving features for rescue teams during emergencies.

The intelligence-driven marine unit has been designed to ensure highly resilient and secure communications with seamless operation, whilst also facilitating a high level of tamper resistance, power efficiency, and a robust marine enclosure, enabling full environmental protection under extreme conditions.

The Outcome

The project is ongoing, but Samer Jammoul, Managing Director at ATLAS Telecom stated: "We have chosen Plextek as a strategic partner for their strong track record in delivering highly resilient communications, and IoT technology solutions for mission critical applications".

ATLAS Telecom awarded Plextek an initial £4.4M contract for the programme's first and current phase, with further phases to follow.





Plextek

We support organisations to bring highly technical products and services to market.

Plextek is a company built on innovative ideas. Innovation runs in the fabric of our company culture. The people we hire, the projects we work on, the way we set up our processes and how we communicate, all support independent thinking and creativity.

Companies come to us to tackle their hardest engineering challenges that need outside-the-box thinking.

Get in touch to find out how Plextek can help you to deliver your next innovation in technology.

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