# **CASE STUDY**

### **SMEs**

#### WHO WE ARE

The Connected Places Catapult (CPC) is an independent, trusted, expert broker operating at the intersection between the public and private sectors and between local, regional and national decision making. We promote UK innovation and broker relationships between government, academia and industry providing support and solutions for innovators to commercialise their projects and research. With our deep expertise in technology, we bridge the gap between buyers, suppliers, innovators and industry. Our agile approach enables us to convene our partners to act rapidly to create new market collaborations responding to public funders and industry needs. We boost demand for innovation to unlock wider economic and environmental benefits.

# The Connected Places Catapult is growing the UK's Small and Medium sized enterprises (SMEs)

#### **Connected Catapult SME Programme**

SMEs are one of the strongest sources of innovative new products and services in the UK's Connected Places sector. Our SME Programme is designed to harness CPC's technical knowledge, market expertise and regulatory experience to help drive growth. The targeted SME Accelerators programme provides intensive business support preparing startups to reach out to investors.

The Intelligent Mobility (IM) Accelerator is a partnership between CPC and Wayra – Telefónica's global innovation arm. It has support from Stagecoach, Hyundai and Amey (Ferrovial in the UK). To date, it has created 24 commercial pilots for startups which have raised over \$250M in investment.



# SensoRail

# Developing innovative acoustic sensors and signal processing to detect rail defects from a moving train



#### Challenge

The challenge was to develop their system from proof of concept, to early prototype and unlock funding for further development. Such development required testing in a laboratorybased simulated rail environment. Success in the lab led to prototype development and access to a representative rail environment for testing and demonstration on a real train.

#### Solution

In December 2017 SensoRail joined over 100 high tech businesses, innovators, designers, coders, business strategists and students from all over the country taking part in a twoday Hackathon organised by HS2 and the Transport Systems Catapult (now Connected Places Catapult) in Milton Keynes. HS2 is looking to embed a next generation asset management strategy that optimises value across HS2 data groups through leveraging the datafication of the entire railway environment. The aim was to challenge Britain's leading tech minds to come up with radical new ideas for how technologies such as wearable sensors, artificial intelligence and virtual reality might revolutionise key aspects of the HS2 rail project.

Six teams were shortlisted out of a total of 17 to take part in the final round in February 2018 including SensoRail. The SensoRail solution focused on the HS2 challenge to using train and track-mounted sensors to 'read' minute changes and IoT to automatically dispatch drones or other technologies for further inspections or even repair.

Starting in September 2019 the six-month long SensoRail Innovation Project involved working with partners to develop and demonstrate the SensoRail system in line with HS2's maintenance objectives. The purpose of the project was to demonstrate that acoustic technology can detect defects on a representative railway system and to show that the technology has potential at higher operating speeds as well as supporting innovative research and development to inform future specifications.

During the project, SensoRail developed novel acoustic sensors and a deep learning algorithm to detect track defects. Two acoustic sensors were used at the University of Birmingham laboratory with support from the Digital Rail Demand-Led Demonstrator programme (DIGI-RAIL) which is run by the Birmingham Centre for Railway Research and Education (BCRRE).

This indoor laboratory has eight rail sections **mounted on a spinning wheel** to simulate a rail wheel rolling on rail. The rail sections have known defects of various sizes and shapes to train and test the defect detection system.

One acoustic sensor was used on the real train at the Quinton Rail Technology Centre (QRTC) in Stratford-upon-Avon to demonstrate the system in a representative environment. QRTC is the UK's only **privately owned and independent rail testing and trialling site.** It has the only looped test track in the UK and is used extensively for reliability and mileage accumulation testing and trialling and operates 24/7.

With the real train testing, the system was mounted under the train on the wheel axles to collect the acoustic signature while the train was running. The audio was recorded in Waveform Audio File (WAV) format, with sampling rate 16,000 Hz and 16-bit depth to provide sufficient quality for deep learning algorithm training process. The train was to run for 13 hours over four days.

There were four main stages in the project to develop the system to detect defects: Collecting the acoustic data while train is running (in real life); data filtration, augmentation (processed offtrain); training the deep learning algorithm (processed off-train) and validating the deep learning algorithm on a real train.

#### Dr Iain Roche, Head of Innovation at HS2 said:

HS2

The judges were hugely impressed with the ingenuity and variety of the ideas, and the sheer quality of innovation from all the teams taking part in the Hackathon. In delivering HS2 we are drawing from a diverse range of individuals and organisations to deliver improved capabilities from within our own sector, and critically from adjacent industries. The outcome is the delivery of new standards in how we design, build and ultimately operate the railway.

#### Meet the Team



**Anwar Almojarkesh** CEO and Founder

Anwar holds 10 patents for sound classification algorithms with applications in healthcare, safety and predictive maintenance for the railway industry and factories. He was granted a Tier1 Exceptional Talent Visa in 2016 as an expert in sound classification. SensoRail has worked with: HS2, CPC, University of Birmingham, Digi-Rail, London Midland, NR and SAMSUNG. He developed a people detection sensor based on acoustic sensors deployed on a level crossing and train stations as part of RSSB funded TOC17 project on Suicide, Trespass and Risky Behaviour Reduction.



Alaa Chalab Hardware and Senor Specialist

Hardware and sensor specialist. Granted a Tier1 Exceptional Talent Visa on 2016 as an IoT experts. Has worked on sensors selection and integrations with a hardware system to ensure getting the core parameters for the sound signature at low cost and power.



**Mohammed Eid Shalabi** CTO and Material Specialist

Materials specialist in transmitting acoustic and vibration signals through solids and fiction roughness. Over 40 years' experience working on materials developing a novel approach to creating a unique material that transmits and receives only valid sound signatures and ejects unwanted noises.



**Mohammed Eid Shalabi** Data Analysis and Machine Learning Expert

Data analysis and machine learning expert. Granted a Tier1 Exceptional Talent Visa in 2017 as an expert in data analysis. Bassam has over 20-years' experience working in leak detection sensors in the oil and gas industry.

#### Outcomes

The project demonstrated potential benefits for:

- Cost saving: An automated solution that can scale to monitor track defects wherever an equipped rolling stock unit is deployed. It enables better decision making and focused manual inspection schedules with low unit cost.
- Efficiency: Reduces delays in the network by predicting when the defect is developing and scheduled preventative maintenance can be planned rather than assets failing during an operational period.
- Time: More informed inspection scheduling to better utilise track access.
- Quality: High accuracy system, sound analysis cloudless (offline), self-trained system that will keep improving over the time because
  of the use of machine learning algorithm. No additional need for a developer or an engineer to update the system algorithm.
- Performance: Low power consumption (battery powered prototype). Operating at speeds higher than current inspection methods.
- Reputation: Less service downtime leading to greater customer satisfaction.

#### **CPC creates value**

- Introducing a range of innovators to the rail industry with the HS2 Hackathon.
- Exposed key rail industry stakeholders to innovative technology thus informing future railway maintenance thinking and identifying new
  application areas.
- Supporting the development of an SME-Rail Industry relationship with SensoRail, HS2 and Network Rail.
- Technical support to enable innovation to develop and be demonstrated within a solid Systems Engineering framework, considering safety, quality control, customer requirements, messaging and the end product.

#### Next steps

SensoRail engaged with Network Rail at a Small Business Research Initiative (SBRI) Rail event in early 2020 and are working with Network Rail, CPC and HS2 to develop their system further and ultimately deploy it in active operation on rolling stock. In order to do this, SensoRail is looking to:

- Collect more data at QRTC and at the Rail Innovation & Development Centre Tuxford owned by Network Rail to refine their system.
- Apply for innovation funding, to extend concept and verification activities. Support from Network Rail, HS2 and CPC is
  ongoing with this.
- Improve system performance with more sensors, upgraded hardware and more efficient machine learning models.
- Produce an analysis comparing current systems used by Network Rail and the SensoRail solution.
- SensoRail is working on a project that complements Network Rail's Ultrasonic Test Unit (UTU) defect detection system that processes faster with cost savings by increasing the accuracy of detecting defects including detecting smaller defects and those at higher speed at 30 miles per hour.

### **Tomorrow's Journey**

Building products to maximise the benefits of new mobility for people, communities, businesses and the planet

#### Challenge for the UK mobility services

According to RAC Foundation motoring FAQs, across all UK car use the average car spends 80% of the time parked at home, is parked elsewhere for 16% of the time and is actually in use 4% of the time. Within cities, mobility services are in danger of increasing congestion and inefficiencies by reducing parking due to dedicated carsharing spaces. Car sharing platforms may even put more cars on roads.

These are the issues that Tomorrow's Journey (JRNY) a Milton Keynes based start-up is addressing. JRNY is an agent of change providing a new perspective on mobility. The JRNY platform aims to solve a fundamental problem of both old and new mobility – chronic underutilisation.

### Generating a collaborative digital ecosystem creating a 'Sharable neutral fleet'

Established in October 2017 the JNRY team believes the solution is to tap unused potential by developing a network of vehicles that can be utilised by any mobility service. JRNY calls this collaborative digital ecosystem the 'Sharable neutral fleet' delivering a connected service beyond the capabilities of a single provider connecting underutilised vehicles assets registered to the JRNY platform. Almost anything mobile can be connected including cars, vans, agricultural equipment, scooters, and bicycles. Telematics enable management of the asset providing clear visibility of its location and activity.

The JRNY Platform takes asset supply from multiple suppliers (carmakers, dealers, rental companies, leasing companies) and matches it with multiple mobility and transport services simultaneously. Ultimately this means the same asset can be used for car share in the morning, for parcel delivery in the afternoon, and for food delivery at dinnertime if that is where the demand is. The JRNY app streamlining access to local vehicles for their customers directly into their apps. JRNY records and stores each instance of use. How CPC contributes to growing JRNY

Tomorrow's Journey

Almost from the day we founded the company the support and opportunities that the Connected Places Catapult have offered us have been invaluable. The access to key decision makers in some of the largest companies in the world has allowed us to introduce our innovation to people we would have struggled to engage on our own.

Nick James - Co-Founder & CMO, JRNY

#### Challenge for JRNY

The JRNY team believes that dealer networks have a vital role to play in facilitating new services entering the market. By leveraging existing infrastructure and networks of staff, repair workshops and valeting, dealers can act as mobility hubs for brands. The JRNY team needed to demonstrate this.

#### Solution

In July 2019 JRNY won a place on the Intelligent Mobility (IM) Accelerator Programme partnership between Connected Places Catapult and Wayra UK in Milton Keynes. The programme is supported by Hyundai, Stagecoach Group and Ferrovial Services. These companies provide mentoring, coaching and access to expertise and networks. The Catapult helped facilitate real-time trials for JRNY.

The first commercial trial of the platform was conducted with a global car maker in 2019. The challenge was to take a heavily underutilised courtesy car fleet at an out of town dealership and let the JRNY platform drive additional usage.

- The OEM selected a location on an industrial park in Manchester.
- An initial fleet of six vehicles were allocated to the programme.
- The fleet was onboarded to three Peer 2 Peer daily rental platforms.
- ◆ The dealer provided free delivery to Manchester postcodes.

#### JRNY in the news [Link]

Karshare are using JRNY technology to streamline processes and improve the utilisation of the vehicles generously donated by members of the public. [Link]

#### Awards

- International Asset Finance Network Finance: Dragon's Innovation Award September 2018
- International Asset Finance Network Finance: Fintech Innovator Award September 2018
- SMMT Driving the Motor Industry: Future Mobility Challenge Finalists September 2018

#### Meet the Team



Chris Kirby CEO

Chris is a respected thought leader in the automotive mobility sector, with 15 years experience across fleet, retail, finance and rental markets. He is also one of the co-hosts of the Auto Futures: Future of Mobility podcast sponsored by Boston Consulting Group.



Sian Gannon

Sian is a commercial lawyer working on fast moving, complex commercial arrangements daily within the logistics industry for one of the largest companies in the sector globally.



Matt Potts CTO

An experienced Lead Developer and Technical Architect Matt has worked for the likes of BT and BAE Systems on big infrastructure projects.



Nick James CMO

Nick is a Chartered Institute of Marketing qualified marketer with sixteen years experience, most recently as Account Director to Mercedes Benz and Volkswagen Financial Services.

#### Outcome

Despite the location not being optimal and the peer-to-peer rental services not having as high a profile as in the South East, JRNY drove 18% additional utilisation in just eight weeks. The company earned many thousands of pounds in additional revenue for the dealership and provided cheaper rentals for the communities in the trial area. The car maker is pushing on with plans to roll this trial out to more locations, with a wider selection of vehicles. In addition to the three peer-to-peer rental services JRNY are providing booking pages for test drives, subscriptions, and corporate rentals.

#### Next steps

- ♦ JRNY has developed a joint proposition with Hyundai to help utilise demonstrator and courtesy cars at their dealerships. Due to COVID-19 the project will resume later this year.
- ◆ JRNY were invited by Ferrovial's UK arm AMEY to apply to the SIMULATE programme which seeks innovative solutions to rural mobility issues.
- This vehicle-as-a-service approach will allow any company with consumer demand, such as a hotel chain that wants to provide transport for guests to spin up services without the capital outlay of purchasing a fleet and managing a fleet.
- The JRNY Platform addresses the two underlying issues preventing mobility services being both viable and scalable the high holding and operation cost of vehicles, and the risk of low utilisation. JRNY provides the vital missing piece that will underpin the success of the intelligent mobility industry.

## Valerann

# End-to-end traffic control and road-monitoring system using wireless sensory chips installed in the road



#### How CPC contributes to growing Valerann

We want our technology to become a standard of how to manage traffic data. CPC were instrumental in our efforts to get in touch with some of the UK transportation industry's top corporate companies and government agencies. CPC were always supportive when it came to our fundraising efforts as well, taking advantage of their wide network of venture investors in the UK. These efforts were most effective due to the *CPC Intelligent Mobility (IM) Accelerator Programme* that we took part in in collaboration with Wayra UK and the Satellite Applications Catapult's Westcott Business Incubation Centre.

Gabriel Jacobson - Co-Founder and CEO Valerann

#### Challenge for the UK

s a key part of the UK government's modern Industrial Strategy, the Future of Mobility Grand Challenge was announced in 2017 to encourage and support extraordinary innovation in UK engineering and technology, making the UK a world leader within the transport industry. This includes facilitating profound changes in transport technologies and business models and engaging with highly innovative SMEs..

#### Future-ready Innovative technology

Valerann was founded with the mission to save lives, improve traffic flow, and support smart vehicle technologies. The Valerann Smart Road System is an AI web-based traffic management platform that produces real-time, high-resolution information about everything taking place on the road. By integrating wireless sensing Valerann's Smart Road Studs – cats' eyes – into roads, the system continuously provides insights and predictions, transforming roads into future-ready, data-generating infrastructure. The system has been installed and tested in real roads in Israel, Spain and in the UK in the Westcott Venture Park in Aylesbury, Buckinghamshire.

Each cats eye has a wireless sensor that senses nearby vehicles, assesses risks, and gauges weather conditions. Information is sent wirelessly to the Valerann user interface Cloud Control Centre app, an interactive dashboard that provides easy to read data and insights with a filtered urgency level to the driver about current road conditions. LED lighting systems within the cat's eyes send drivers messages by turning blue to show icy roads or making a single lane red to signal the road is closed. This helps drivers make better decisions, improves safety and cuts emissions.

The system meets the needs of road operators and can be integrated into current traffic management technologies. After installation little human intervention is required in identifying, managing, and handling events. Once past the UK testing stage, this technology will be part of an ecosystem where connected and non-connected vehicles co-exist by passively sensing locations and trajectories of all cars on the road. Sharing data will ensure connected vehicles are aware of each other.

The system provides real-time data and connectivity services for CAVs. In harsh weather conditions, low visibility and in areas with faded markings, autonomous vehicles face one of their biggest challenges – placing themselves exactly in the middle of the lane.

#### Challenge for Valerann

The UK challenge for Valerann was accessing real time testing and real time analysis of continuous data sets to build on existing evidence. Working with highway operator Ayalon Highways Co the system was successfully installed and tested in Israel on a 250-meter section of the Ayalon Highway with Annual Average Daily Volume (AADV) of 800K/road. Working with Globalvia, it was installed in a 250 meter stretch of highway in Spain with AADV of 30K/section. Trials of count/classify vehicles show accuracy levels within 96-98% accuracy.

#### Solution

In November 2017 Valerann was accepted onto The Intelligent Mobility (IM) Accelerator Programme powered by the CPC and Wayra UK partnership. The six-month long programme provides office space, mentoring, networking and access to CPC's worldleading Data, Visualisation, Customer Experience and Connected and Autonomous Vehicle capability teams.

With continuing support from CPC, Valerann identified the collaborative partnership to enable real time analysis from real road UK testbed trials. In collaboration with the Satellite Applications Catapult in September 2019 Valerann established a test bed at the Westcott Venture Park in Aylesbury. Cats eyes were installed over a 200 metre stretch along two lanes on the main entrance road at Westcott to evaluate how the system works in UK weather conditions as well as collecting traffic information. This recreated the exact Wdriving pattern of every vehicle on the road including tracking where they are within or along the lane and how they interact with other vehicles. This testing provided data collections from a lot of traffic and allowed for experimentation in a controlled environment.

#### CPC creates value

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#### Meet the Team



**Shahar Bahiri** Founder, CPO

A visionary tech entrepreneur with years of hands on experience in leading multidisciplinary systems, road infrastructure and traffic management projects.



**Michael Vardi** Co-Founder, CBO

BCG Consultant focused on CAVs and transport. Led Israeli PM office efforts to transform multiple government agencies to data-centric organisations. MBA (LBS), BA



**Avi Tel-Or** VP R&D

A tech leader with more than 25 years of experience in leading multidisciplinary projects from concept to globally shipping products. **BSc (Technion)**, **MBA** 

Mark Joseph – Mobility Previous CEO of Transdev North America, Veolia North America

**Ur Omry** – Intelligent Transportation Systems Previous CEO of Qualcomm Israel, CTO of Derech Eretz (Israel's biggest toll road operator)

Haim Hibsher – Technology Previous CTO of Elbit Systems

#### Valerann in the news

- Smart Roads Traffic Management Leader Valerann Wins Best of Innovation in the 2020 CES Innovation Awards
- Transport for West Midlands is leading a new £8 million consortium to open up travel data. Consortium includes Jaguar Land Rover, Bosch, Warwick Manufacturing Group and three innovation partners: Valerann, Synaptiv, and Immense.

#### Next steps

As a member of a consortium headed by Transport for the West Midlands, Valerann is developing the specific use cases for a national data exchange to be named ConVEx. Total investment will be £8 million with £4 million of funding coming from the UK Government, matched by a further £4 million from the private sector. The next phase of the project September to November 2020 will include integration work with Jaguar Land Rover systems. Valerann plans to demonstrate live data exchange between the road/infrastructure and JLR's connected car in Q1 2021.

#### The Intelligent Mobility Accelerator Programme

The programme has generated over 30 commercial pilots for the 28 start-ups that have previously participated in the programme. Combined, these start-ups have raised over \$250M in external investment. [Link]

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**Gabriel Jacobson** Co-Founder, CEO

Entrepreneur with a passion for impact companies. M&A expert with years of experience in leading diverse teams through key multi-billion dollar M&A deals. **MBA (LBS), LLB** 



Daniel Yakovich Co-Founder, COO

Passionate entrepreneur and experienced operations officer, responsible for UK's & IL's daily operations and business. Years of hands on in the transportation industry.



Ran Katzir Director of Data Science

A recognised tech leader with over 25 years of experience managing innovation both in the private and public sector, in Israel and in the UK. **BSc**, **MSc** (Technion) MBA

