

Deteriorating road infrastructure and pothole-related hazards pose significant challenges for municipalities and local councils.



Potholes not only compromise road safety but also lead to costly vehicle damage, increased repair expenses, and growing public dissatisfaction with service delivery.

The average cost of pothole damage to a vehicle is now **£460**, with the **AA reporting that 1,700 vehicles need repairs each day**, translating to an overall **annual cost of £597 million**. This adds a tremendous financial burden on taxpayers and motorists, with the RAC estimating **£1.6 billion** for England alone to address potholes in the next financial year.

Despite the high taxes paid by road users, the damage caused by potholes is still growing, and there is increasing pressure

for more effective, proactive solutions. With the Department for Transport holding back 25% of the £500m uplift unless authorities present deliverable results, it has become even more pressing to create a balance between budget constraints and maximising road infrastructure repairs. Many councils have expressed concerns about the limiting of funds.

The UK Government encourages citizens to report potholes and other infrastructural issues via an online pothole. Asking the already disgruntled public to be responsible for reporting potholes is likely to only add to their frustration.

Local councils or highway authorities often have to perform manual inspections to verify

£460

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Projected funding needed for England alone to address potholes in the next financial year.

reported potholes, as well as for regularly scheduled inspections. Inspections are often performed monthly, or sometimes annually. This means that there are extended periods between inspections where potholes may be left unchecked. Specialised highway vehicles have to be dispatched specifically for this purpose, leading to additional expenses and time-consuming tasks.

To solve this issue, we developed SPOTTER, an AI-powered pothole detection system that is compact, intelligent and designed for real-time environmental monitoring and analysis. Enabling councils to move beyond reactive maintenance, ensure efficient budget allocation, resource management, and improve service delivery.

This small, robust AIoT device has been made so that it can fit not only onto existing council and fleet vehicles, but onto any vehicle. It continuously analyses road conditions, detecting abnormalities and enabling real-time, automatic reporting of issues.

SPOTTER is weather resistant, with an easy installation process and minimal maintenance requirements.

At its core, it is powered by a minicomputer, equipped with a Neural Processing Unit (NPU), accelerating inference for object detection, classification, and other computational tasks. Detection is performed on-device in real-time before sending data to the backend to reduce data costs, taking only milliseconds to complete pre-processing, inference and post-processing of images.

A camera unit provides visual input, capturing real-time images and video for analysis, while a LiDAR module enhances spatial awareness, enabling precise distance measurements and environmental mapping. The camera unit is able to produce optimal results under various light and weather conditions, providing advanced image processing for reliable identification and classification. The LiDAR model creates accurate 3D measurements of potholes and

High-Resolution Camera Detection

- Real-time visual detection of surface deterioration
- Advanced image processing for reliable identification and classification
- Optimal performance under varying lighting and weather conditions

LiDAR Surface Profiling

- Accurate 3D measurement of potholes and road imperfections
- Detailed surface gradient mapping and volumetric analysis
- Precise dimensional data (length, width, depth) of detected features

GNSS/GPS Positioning

- High-accuracy latitude and longitude coordinates
- Real-time vehicle speed and travel direction tracking
- Enhanced positional accuracy for precise mapping

Integrated LTE (4G) Connectivity

- Live transmission of road condition data directly to secure cloud servers
- Remote data access for immediate assessment and response
- Reliable connectivity with low-latency data upload

road imperfections with precise dimensions.

A GPS module allows it to record positional data and operate effectively in various terrains, providing high-accuracy latitude and longitude co-ordinates with real-time vehicle speed and travel direction tracking.

An LTE connection ensures constant connectivity, enabling real-time reporting and cloud integration with low-latency data upload. LTE connectivity ensures remote data access for immediate assessment and response.

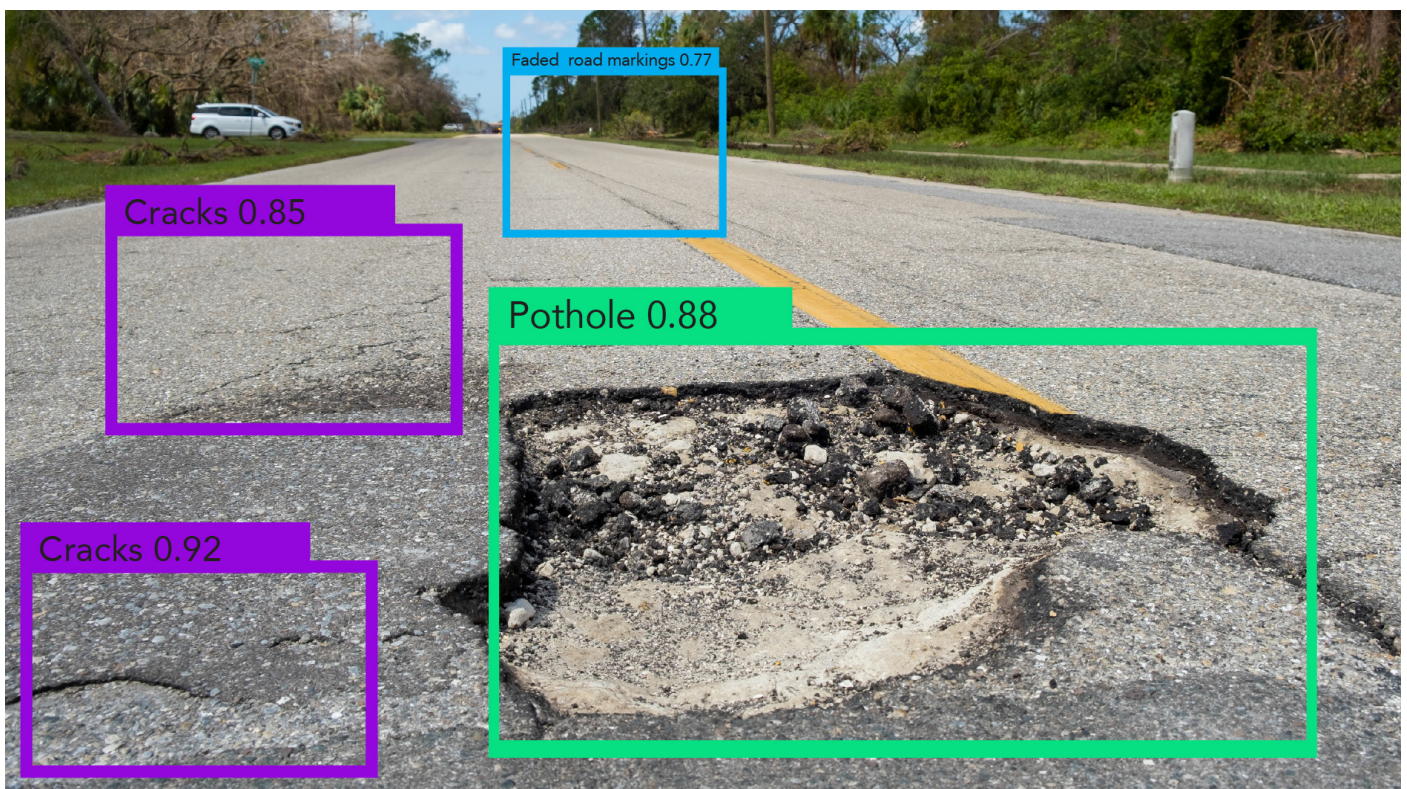
How SPOTTER Works

SPOTTER divides images into grid cells for precise issue localisation. It then uses feature extraction and classification to distinguish different road defects. The Genetic Evolution Algorithm improves anchors over time. Extensive model training ensures accuracy and recall. Data augmentation techniques ensure better recognition of issues in various lighting and weather conditions.

As it improves, this technology will become instrumental not only for councils but also for security and public safety – identifying emergencies or crime and reporting in real-time to ensure quicker responses. The SPOTTER model has yielded highly accurate results across a large database and continues to be refined.

SPOTTER seamlessly integrates with My Smart City, a leading citizen engagement and service delivery platform already in use across South Africa. This integration enables councils to leverage citizen-reported issues alongside AI-detected potholes for a holistic view of infrastructure needs, ensuring faster response times by automating issue prioritisation and resolution – improving municipal efficiency by centralising road maintenance workflows. Through My Smart City, users can also receive real-time, AIoT verified data providing early warnings of potholes that could damage their vehicles.

The report data gathered by SPOTTER is automatically sent to Forcelink's back office – Acumen Software's advanced Mobile Field Service ERP (Enterprise



Resource Planning). Forcelink offers high adaptability and configurability, providing the flexibility to tailor services to meet the unique requirements of each business.

Once issues are logged, the back-office AI Scheduler will schedule the repair based on priority, determine the type of repair, and calculate the materials required – allocating the correct resource for the job and providing them with instructions to ensure first-time resolution.

Early detection and AI driven reporting can minimise vehicle repair claims, extend road lifespans by 30%, reduce emergency repair costs by 40% and reduce manual surveys by 70%, saving councils millions annually.

With a flexible, scalable pricing model, SPOTTER ensures accessibility for organizations of all sizes. Coupled with advocacy from high-profile campaigners,

we're driving awareness and accelerating the adoption of smarter, more sustainable infrastructure management solutions.

Despite SPOTTER's primary focus on pothole detection, it is also able to accurately detect other infrastructure issues, such as faded road markings and cracks. As SPOTTER continues to be refined, it will be able to detect even more issues.

SPOTTER can also be utilised by fleet operators and logistics companies to passively collect real-time data on road conditions during daily operations. This data can help logistics companies reduce operational risks, lower maintenance costs, improve delivery efficiency, and engage proactively with local infrastructure planning.

SPOTTER detects, reports, and closes cases dynamically, keeping cities running smoothly and enhancing public trust.

Technical Summary

Specifications	Descriptions
Detection Capabilities	Potholes, Cracks, Road Surface imperfec-
Data Output	Images, 3D LiDAR scans, Gradient,
Connectivity	LTE (4G), Continuous real-time data
Positioning Accuracy	GNSS/GPS with precision tracking
Environmental Resistance	IP-rated enclosure, rugged build
Power Supply	Compatible with vehicle power systems
Data Integration	Cloud-enabled for instant analytics