

Artificial Intelligence & Underground Assets Business Challenges Workshop

Findings

October 2017



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Artificial Intelligence and Underground Asset Identification and Inspection Workshop

Held on 16 October 2017, the Artificial Intelligence and Underground Asset Inspection Workshop engaged with Small to Medium sized Enterprises (SMEs) and academics to develop solutions to two business challenges. The first section of the workshop focused on artificial intelligence and its potential application across Amey, whereas the second section addressed the specific challenge of underground asset inspection using new technologies.

The two workshop sections asked the following questions:

1. Discovery Workshop session 1: Artificial Intelligence (10:00-12:00) Key Questions

- What areas relating to the challenge are of interest to you?
- AI is a broad area. Are there specific technologies which could be of interest to Amey?
- What further information is required to develop a solution?
- Would multiple organisations need to work together to develop a solution?
- What commercial opportunities might exist for developing the solution?
- Are 'off the shelf' solutions available?
- Share your views on the various technologies you propose with regards to the TRL level

2. Discovery Workshop session 2: Underground Asset Identification and Maintenance (13:00-15:00) Key Questions

- What areas relating to the challenge are of interest to you?
- How could technologies be used to address the challenge?
- How would technologies overcome problems of operating underground/ in confined spaces etc?
- What further information is required to develop a solution?
- Would multiple organisations need to work together to develop a solution?
- What commercial opportunities might exist for developing the solution?
- Are 'off the shelf' solutions available?
- Share your views on the various technologies you propose with regards to the TRL level

Workshop Attendees

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Please see appendix for sign in sheets

Workshop Findings (Please see Appendices for workshop notes)

Discovery Workshop session 1: Artificial Intelligence

The emerging trends from the morning session regarding the application of AI were as follows:

- Management of transport networks:
 - Traffic flow, congestion and air quality management: There is potential to use machine learning and advanced analytics to work with complex transport data to identify trends and enable better network management through predicting congestion before it occurs through learning from past transport trends. The challenge though is deploying this in the real world in a meaningful way as the Local / Transport Authorities have limited tools to respond to this. Where the congestion is design driven (e.g. pinch points) they can re-design the transport network, however, where it is capacity driven they have limited tools to respond to it.
 - Predictive analytics: Application of this technology could analyse sensor and maintenance data to identify asset deterioration and asset failure. This is an area of interest to Amey as we hold a range of data sources. The challenge, however, is demonstrating that an intervention, based on predictive analysis, will deliver value for money (e.g. certainty of deterioration vs rectification costs)
- Management of Utilities networks:
 - Predictive Fatberg formation: This is an area of current focus in the media and one of interest to Amey through its management of numerous sewer contracts. There is the potential to combine data from various sources (local business including restaurants, network pinch points, historic data, sensors) to predict future formation and then take actions to prevent them from occurring (e.g. targeted sensors, public awareness campaigns)
- Management of waste collection (in terms of street bins):
 - Predictive waste collection: There is an opportunity to use machine learning and analysis to identify future waste collection trends and design waste collection schedules which are reflective of predicted waste accumulation of streets. Sensor installation could enable this to occur, combined with people movement patterns. This could deliver potential savings through a reduction in a number of collection cycles. Please note that Amey already has a pilot project focused on this.
- Management of invasive species (Japanese Knotweed)
 - Developments in image processing and machine learning will enable AI to be deployed in identifying invasive species like Japanese Knotweed on rail and highways verges. This application shows merit and could potentially be deployed in Amey.
- Robotic Process Automation

- This is an area which shows promise for the deployment with AI in Amey. This is key for supply chain demand and invoice/payment processing.

Discovery Workshop session 2: Underground Asset Identification and Maintenance

- There is currently no off the shelf solution which would enable live 'out in the field' asset identification, however there is an opportunity to combine data from multiple sources (GPR, Acoustics, 2D/3D automated image analysis, CCTV, ect.) to provide a single view of underground assets while out in the field. If operatives have a single digital view they can see all of these assets in one place, thus making their job easier and safer. Information sharing across multiple organisations is key to this.
- It is difficult to provide a 'live' view of assets as the challenge is that different types of asset require different surveying techniques to identify them. There is the potential to create a solution which could identify multiple asset types, however this would require improved sensor technologies. A key challenger, however, is consistency of data AND reliability.

Next steps




Amey will work with those who attended the workshop to develop the concepts further.

Appendix

Project sign in sheets

Underground Assets & Artificial Intelligence - Amey Challenges Workshop
Monday 16th October 2017 - 8:30am - 4:00pm

First Name	Surname	Email Address	Job Title	Company Name
SHIRLEY	HODSON			IBL
DEBBIE	ASSUNDA			ROCKNORTH CONSULTING



European Union
European Regional Development Fund
 


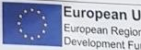

Registration

Amey Workshop:
Underground Assets & Artificial Intelligence
16 October 2017

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Registration

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European Union
European Regional Development Fund
 

Underground Assets & Artificial Intelligence - Amey Challenges Workshop				Underground Assets & Artificial Intelligence - Amey Challenges Workshop			
Monday 16 th October 2017 - 8:30am - 4:00pm				Monday 16 th October 2017 - 8:30am - 4:00pm			
First Name	Surname	Company	Tick Attendance	First Name	Surname	Company	Tick Attendance
Nic	Cary	Waysphere Ltd		Nic	Cary	Waysphere Ltd	
Andi	Clark	Crown Highways Ltd		Andi	Clark	Crown Highways Ltd	
Josh	Dale	383 Project		Josh	Dale	383 Project	
Stig	Hansen	New Forest Communications		Stig	Hansen	New Forest Communications	
Mark	Hawkins	Citi Logik Limited		Mark	Hawkins	Citi Logik Limited	
Diogo	Henriques	Northumbria University / Freelance		Diogo	Henriques	Northumbria University / Freelance	
Joe	Herron	Murphy Power Distribution Limited		Joe	Herron	Murphy Power Distribution Limited	
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Paul	Muston	Musoft Ltd		Paul	Muston	Musoft Ltd	
ramesh	Paswan	Jacobs		ramesh	Paswan	Jacobs	
John	Poole	Vionice Ltd		John	Poole	Vionice Ltd	
Simon	Riley	HON		Simon	Riley	HON	
Hugo	Russell	Innovation Birmingham	✓	Hugo	Russell	Innovation Birmingham	
Navdeep	Singla	On Device Solutions		Navdeep	Singla	On Device Solutions	
Paul	Sutherland	+ADD Strategy Ltd		Paul	Sutherland	+ADD Strategy Ltd	
Vinnett	Taylor	O2		Vinnett	Taylor	O2	
Nigel	Taylor	sol.vai Ltd.	✓	Nigel	Taylor	sol.vai Ltd.	
LUJUN	WEI	University of Leeds (School of Computing)		LUJUN	WEI	University of Leeds (School of Computing)	
Dean	Whitbrook	DDC Engineering Solutions Limited		Dean	Whitbrook	DDC Engineering Solutions Limited	
Murali	Yeddula	OnDevice solution ltd	✓	Murali	Yeddula	OnDevice solution ltd	

Workshop notes

Discovery Workshop session 1: Artificial Intelligence

1. Table 1

- Data collection:
 - Catalogues
 - Identification
 - Legals/ownership
 - GIS
 - Broadly accessible: Anything is better than nothing
 - Open data
 - Meta info
 - Security/ Ownership (Economics)
- Models
 - Codification of expert knowledge
 - Machine learning
- Data Sources
- Existing measurement systems
- GIS
 - Open 311 (Field data collection)
 - GPS
 - What three words (OTS)

- Open street map (OTS)
- Google time machine street view (OTS)
Example- Vault Scotland
- Critical infrastructure
 - Power/Telecoms#
- App/Phone Provision of Photo/Video (Pre/Post Work)
 - Accuracy – Norway 2.1m- Asset locations
 - OTS “One up” gamification (Amey Vehicle & staff)
 - Postal service – data collection daily
- Info Needs
 - Decision on ‘what is broken’
 - Real world analytics
 - Use series of collection tools
 - Avoid one system
 - TIP: Series of microservices within Enterprise – Domain specific – certain problems
 - TIP: APIs everywhere- ZAPIER/IFTTT.com
 - TIP: Semantics of the data
 - Prototype – Opportunities to attach on side main project (Pilot fish)
- Commercialisation
 - Contractual obligations – measurements
 - Dependency graph for info (Ontologies – the meaning of data)
 - Transport planning – traffic flow/Bypass/disruptions: Live/post analysis of model. ITO motion visualisation – Saturn data
 - Co-ordination between emergency and planned works
 - Command & control system
 - Joint operations (influence priority)
 - Dirty Analytics – missing potential
 - Sensors & other data (Met office/events)
 - Opportunity: Road maintenance/ Fat bergs

2. Table 2

- Drainage surveys
- Different type of tech to survey
 - Challenge is to identify lots of different info. No simple tech gives everything
 - Cameras, acoustic sensors
 - Asset condition – getting basic condition survey at simple level
- Highways England DDMS (England & Wales)
 - HE want staff on ground to confirm assets
- Reason/value/purpose of surveys
 - Issue of trust... redoing
- Amey biggest problems: H&S and underground assets
- Predictive maintenance

- IoT sensors (bins)
- Use of machine learning to analyse / assess patterns with sensors data
- Movement of people – adjust transport solutions to keep traffic/congestion free
- Through people behaviour to help address & manage congestion
- Road condition sensors
- Asset data used to influence/adjust behaviours – improve congestion / air quality etc
- Asset data used to manage assets better
- Base data collected on assets
- Collaboration Software (E.g. road closures, PPM- cost savings, Rubbish sensors, More central network management)
 - Collaborating contractors
 - To help public/commercial opportunities
 - IoT/ deep learning/ network of solutions
 - Communications
 - Surveys/Transport
 - Accessing/ sharing data + generate (or not collected)
 - Understanding what is already available
 - What regulations/restrictions
 - How to make sense of data
 - Development required- cost involved. No off the shelf solution
 - Get all agencies at every level to work together
 - Issues – NDAs, Contractors, IP, Exploit the data, incentivise to share data even if separate.

3. Table 3 (Solv.ai)

- AI recreating travel experience – immersive therapy
- AP – Back office – efficiencies -RPA
- Regtech
 - Human interaction
 - Visual interaction (Japanese Knotweed)- Proof of concept
- Invasive species management
- Asset failure & Liability
- Consumer demand (stations)
 - Human interactions
 - Predictive
 - Analysis (data)
 - Process automation
- Personal safety (trains) – predictive
- Predict supply chain demand
- Integration of systems
- Weather prediction – track safety

Discovery Workshop session 2: Underground Asset Identification and Maintenance

1. **Table 1** (Dean@ddc-uk.com, d.lowe@aston.ac.uk, L.J.Wei@leeds.ac.uk – assessingtheunderworld.org)
- Automated recognition of different anomalies – then classification condition analysis
 - Data fusion (GPR, Acoustic, Visible Camera, Prior knowledge, context. Environment)
 - Technologies
 - GPR, Acoustics, 2D/3D automated image analysis, ML, CCTV combined to identify anomaly
 - NOTE: Improved sensor technology would help
 - Information needed? – sharing/ access to data + annotated databases in different conditions
 - Team effort needed
 - NO current off the shelf solution BUT optimism of viable solution
 - Solution should be portable, easy to use, live