SETA

SETA is a 3-year European research project aiming to create Big Data technologies and methodologies set to change the way mobility is organised, monitored and planned in large metropolitan areas. The solutions are based on large, complex dynamic data from millions of citizens, thousands of connected cars, thousands of city sensors and hundreds of distributed databases.

Professor Fabio Ciravegna, SETA Director

The SETA solutions are based on the management of high-volume, high-velocity, multi-dimensional, heterogeneous, cross-media, cross-sectoral data and information which is sensed, crowdsourced, acquired, linked, fused, and used to model mobility with a precision, granularity and dynamicity that is impossible with today's technologies.

SETA is creating methodologies and technologies for: (i) Effective and efficient gathering of large-scale heterogeneous data and information sensed by physical sensors, mobile devices, collected over large scale via participatory sensing and crowdsourcing, as well as derived from institutional, public and private bases; (ii) Designing and developing real-time, personalised and ubiquitous transport and mobility services for citizens and businesses; (iii) Designing and developing a dashboard for decision makers which will allow effective daily and long-term planning of transport in the metropolitan areas, as well as support resilience and safety of mobility. Scientific and technological advancements will concern:

- New methods of crowdsourcing data and information from citizens over large scale via participatory sensing (e.g. via mobile phones and low cost sensors) and passive sensing (e.g. via large scale analysis of social media) that will enable pervasive, low cost, large scale high-granularity multimodal sensing over metropolitan areas;
- New methods and algorithms fusing data from thousands of sensors across the metropolitan area with citizen data and hundreds of large databases (e.g. providing road layouts, maps, raster images, social data, etc.) in highly-dynamic, high-dimensional, high-velocity, heterogeneous data spaces;
- Predictive models able to work in these complex spaces and model entire geographical regions (e.g. areas covering hundreds of km and millions of people);
- Methods for real-time mobility decision support for citizens, businesses and decision makers based on this large-scale, highly-dynamic, high-velocity heterogeneous multidimensional data.

Expected Outcome

The expected outcome will be a replicable strategy for deploying the SETA solution in dozens of cities, including a precise strategy for involving thousands of citizens and to integrate with diverse existing infrastructures and data. The solution will then be commercialised throughout Europe by a partnership of companies mixing experienced consultants and technology developers.

The Case Studies

SETA is heavily based on real world requirements and data. For this reason the project will implement use cases in three different but complementary metropolitan areas in Europe, all of which have extensive and intense mobility and transport issues: Birmingham, UK; Turin, Italy; Santander, Spain.

Birmingham, UK

Birmingham is the 2nd largest city in the UK, with a population of 1.1m rising to 1.24m Daytime Population covering 267 square km. Birmingham will provide a testbed to analyse, design, develop and evaluate a use case related to management of mobility in the large metropolitan area with a specific focus on both motorised and non-motorised mobility.

The SETA project is aimed to assist the city to face transport issues such as: predicted significant rise in traffic by 2020; increasing congestion. As personal mobility has increased, the existing transport system has come under pressure. This requires the City Council to provide alternatives so travellers can make sensible choices. The SETA project allows Birmingham to improve: non-motorised transport; cycling provision in the city; local links to cycle routes; decision maker's intelligence to make better informed decisions; the citizen's mobility planning of their journey i.e. time, costs, best alternative routes.

Turin, Italy

Turin is has a population of 890,000 inhabitants and a metropolitan area of 1.6m inhabitants, overseen by 315 local councils and distributed over 6,829 square km. Turin records 978,000 transport journeys everyday, of these: 562,000 are internal to the city; 276,000 are commuters from the wider metropolitan area to the city centre.

SETA will provide Turin with the chance of increasing their knowledge of mobility needs and pattern. Turin will provide a testbed for testing and validation of the SETA solution, through the following activities: (i) The mobility planning applications will be released to thousands of citizens and business to help plan their everyday transport and will provide ubiquitous crowdsourcing and sensing; (ii) the SETA decision maker dashboard will be used by the city council for daily and

Images of the three cities from Wikipedia

long term decision making and planning. In particular the dashboard will be integrated in the traffic and emergency control room managed by the City of Turin through their controlled company 5T. (iii) The SETA solution will be used to integrate existing infrastructure data with new transport data from physical and social sensors, allowing ubiquitous information currently impossible.

Santander, Spain

The city of Santander is the capital of the Cantabria region in the north of Spain and has a population of 172,000 inhabitants. In recent years, the city of Santander has moved into the vanguard of smart cities, improving public services and developing policies oriented towards its citizens and the stimulation of a new business model of productivity for the city. SETA will support the following policies:

- Management and traffic control;
- Optimal management of information for users;
- Optimization and improvement in data collection;
- Planning and management of public transport;
- Incorporate the measurement of mobility systems quality as another variable to consider.

Santander plan to involve hundreds of citizens and businesses as well to test and use the SETA infrastructure as part of their internal decision process.

Workplan

The workplace is organised around 5 technical work packages plus one application workpackage.

Luca Bolognini, Aizoon

WP1 *Smart mobility in three diverse metropolitan areas: the three cities*; this covers activities and actions related to the SETA use cases: the city environments will be studied, requirements derived (M6) and then the methodology and technology is deployed and preliminary tested (M13). Then final test will last 6 months. Work package 1 will reach its objectives through testing the effectiveness and viability of the SETA solution in real- life cases, testing the benefits of using the technology, methodology and tools. In each city the project will deploy technologies to acquire information from static and mobile

physical sensors and social media monitoring; engaging citizens as both active and passive sensors. The information will be fused and used to develop models. Finally, services will be developed and deployed to citizens, decision makers and business.

Fabio Ciravegna,
The University of Sheffield

WP2: *Pervasive social and physical sensing for smart mobility will develop the algorithms, data structures and methodologies for collecting and analysing data either from physical or from social sensors*. This work package will define methodologies and technologies for the acquisition and analysis of extremely large scale data, of a highly dynamic nature, and from heterogeneous sources. Data and information will be provided by a wide range of providers, from citizens, to business authorities through the usage of multiple sensing and crowdsourcing technologies. Data acquisition will focus on three paradigms of technologies, via passive sensing, participatory sensing and opportunistic sensing via social media sources. Additionally, methodologies and technologies on opportunistic sensing of large scale video data from camera networks are to be developed in WP3. The challenge of SETA is twofold: 1) to make participatory sensing widespread and part of everyday life for citizens, with clear usage and benefit for users; 2) to create sensing technologies able to cope with high number of users and high velocity.

Mila Mihaylova,
The University of Sheffield

WP3: *Data fusion methods in high dimensional transport systems will devise methodologies for data fusion across mode and modality of very complex data*. Intelligent transportation systems and intelligent mobility rely on processing data from different sensors. Large volumes of data are provided by video cameras (e.g. via deep learning methods), magnetic loop detectors, GSM and multimedia data (such as Twitter). These are processed in transportation centres for traffic monitoring and prediction and also efficient monitoring and prediction algorithms are needed for choosing the best routes by vehicles, cyclists and pedestrians. WP3 focuses on the tasks of traffic monitoring and estimation based on fusion of the data incoming from multiple sensors. Once found these estimates can be used in traffic modelling and route planning. Large scale traffic networks are considered, giving the following challenges of the high dimensions, fusion and measurement uncertainties are addressed by efficient Bayesian methods (sequential Monte Carlo filters) and methods of describing a road network in a compressed way. Initial results are obtained with macroscopic traffic models.

Jörgen Sandig,
Scyfer

Hans van Lint,
Delft University of Technology

WP4: *High dimensional predictive models for smart mobility:* we will will turn the Big Data acquired and fused in WP3 into city mobility models, utilising data and allowing modelling at previously unattempted levels of dynamicity and timeliness. Congestion ultimately is the result of a mismatch between traffic demand (how many people want to travel from A to B) and traffic supply (the prevailing capacity and level of service in a network). Predicting traffic is complex because both demand and supply are the result of millions of drivers and travellers interacting and making decisions. In this work package we develop methods to predict important traffic supply variables (speeds, travel times) in large networks using whatever data and information are available. We also work on methods for predicting traffic demand - specifically for public transport such methods are scarce. In turn these demand and supply predictions can be used to support more informed decision making by travellers and network operators through the tools developed in SETA.

Vita Lanfranchi
Knowledge Now Ltd

WP5: *Large scale visual analytics and decision making for smart mobility in metropolitan areas.* WP5 has the role of providing decision support to all the SETA stakeholders (local authorities, citizens, communities) via large scale visual analytics and dedicated services in order to effectively address mobility issues in urban areas. It focuses on new methodologies and technologies for contextualising high variety, high velocity and high volume data to highlight events, behaviours and trends for the decision maker to quickly perceive the relevant issues/problems/features in the environment. The outcome of the workpackage is to develop a dashboard customised for different stakeholders needs and roles (authorities, citizens) that can be accessed through multimodal devices in the form of web platform, apps and services.

Marcin Sieprawski
SoftwareMind

WP6: Management of large scale data for large scale pervasive smart mobility: The role of this work package is developing a cloud-based platform integrating all SETA solutions into a coherent system. This will be achieved by providing a robust cloud-based infrastructure in which large volumes of heterogeneous, multimodal, dynamic mobility data can be stored, manipulated, queried and extracted with low latency. At the heart of this distributed cloud infrastructure will be the flexibility to deal with multiple sources of Big Data whilst providing a single logical endpoint for querying. WP6 will deliver a scalable, efficient, expressive, and continuously available spatial querying

system and interface to support analytical queries over large volumes of spatio-temporal data. To ensure data protection and privacy legislation are responsibly monitored and implemented, WP6 proactively embeds them in the entire development cycle of the Data Management Platform following Privacy by Design principles.

The Consortium

The consortium involves partners from 5 countries, UK, Italy, Spain, Poland and Netherland. The majority of partners in the consortium are companies - 5 are SMEs and one is a large company. The consortium is led by The University of Sheffield (Prof Fabio Ciravegna) who has a long track record in coordinating successful European projects (WeSenseIt, X-Media, Dot.Kom) and a solid experience in co-creating ground-breaking research spinouts, two of whom are involved in this proposal. The stakeholder partners represent cities that have similar and complementary nature: one in Italy, one in Spain and one in the UK.

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The First year

The first year of the project has covered 6 months of requirement analysis where the different case studies and work packages have derived the requirements for the project and set out their plans for the first phase of the project. The public deliverables are available on the project website at setamobility.eu.

Development of the first version of the SETA technologies will last until month 15 (April 2017), to be followed by a 3 month evaluation in vivo in the three cities. A final phase of development and evaluation will last until end of January 2019.

Meetings

We met four times:

- Project kick off in Sheffield in February 2016 hosted by The University of Sheffield
- Barcelona meeting in June 2016 hosted by TSS
- Turin meeting in October 2016 hosted by the Turin City Council
- Milan meeting in January 2017 hosted by Aizoon

Contacts

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