WP4 Pilots, citizen involvement, integration and validation.
D4.2 Pilot preparation and citizen involvement

BIGCLOUT

Big data meeting Cloud and IoT
for empowering the citizen ClouT in smart cities

H2020-EUJ-2016 EU-Japan Joint Call

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ABSTRACT

This is the second iteration of a core deliverable designed to layout guidelines and methodologies for the preparation and running of BigClouT city trials. Deliverable D4.1 (M9) set out the initial guidelines and methodologies. This deliverable updates those guidelines based on initial trails and where appropriate offers lessons learnt from the initial trials.
Note, this deliverable should be read in conjunction with D4.1 - which contains more background information on the guidelines for trials. D4.2 has summarized that information and concentrates more on the trials plans.

Disclaimer

Revision history

Revision	Date	Description	Author (Organisation)
V0.1	2017-12-04	Initial ToC	RJL (LANC/NTTE)
V0.2	2017-12-11	Added GRE content	KM (GRE)
V0.3	2017-12-13	Added FUJ content	TY (KEIO)
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EXECUTIVE SUMMARY

This is the second iteration of a core deliverable designed to layout guidelines and methodologies for the preparation and running of BigClouT city trials. Deliverable D4.1 (M9) set out the initial guidelines and methodologies. This deliverable updates those guidelines based on initial trails and where appropriate offers lessons learnt from the initial trials.

Note, this deliverable should be read in conjunction with D4.1 - which contains more background information on the guidelines for trials. D4.2 has summarized that information and concentrates more on the trials plans.

In addition, this deliverable takes into consideration feedback from the Year 1 review. In particular:

Review comment	Action
Specific KPIs are set for the use case trials, however their reaching potential and status up to now is not fully documented in the report.	Table on KPIs has been added to each use case and where appropriate an indication of status.
A table summarizing the different ethics requirements per use case along with their importance and risk should have been included.	Table on ethics have been added to each use case.
Also reference to the EU RRI principles should have been included. Very generic reference to RRI – it is not evident if the consortium has respected last year's comments to get advice from http://www.rri-tools.eu/how-tos	BigClouT's FT guidelines are closely aligned with the RRI. To highlight this, a new section (2.1.1) on RRI has been added and where appropriate, alignment has been highlighted in the different sections of this deliverable.
Better linkage to requirements in WP1	Where appropriate, specific linkages from KPIs to requirements (D1.2) have been added to the KPI table.

INTRODUCTION

This document provides guidelines and methodologies for the preparation and running of BigClouT city trials. Deliverable D4.1 (M9) sets out the initial guidelines and methodologies. This deliverable updates those guidelines based on initial trails and where appropriate offers lessons learnt from the initial trials. In addition, this deliverable takes into consideration feedback from the Year 1 review.

A core aspect of the BigClouT project is a set of real-world trials that will be run in the participant cities, i.e. Bristol, Fujisawa, Grenoble and Tsukuba City (See Figure 1). These trials are designed to test the BigClouT architecture and platforms to ensure that technological developments meet the needs of cities allowing them to exploit BigClouT results to develop and deliver new Smart City applications and services.

FIGURE 1: BIGCLOUT PARTICIPATING CITIES

1   BACKGROUND & PURPOSE

These trails will be used to validate aspects of the BigClouT architecture and ensure the project meets its main objectives. In particular the trials will help validate objectives 1-3 which focus on technology development and objective 5 which focuses on long term sustainability, ie legacy. However, the trials are most directly related to ensuring the project meets objective 4.

- OBJ1. To build an interoperable architecture enabling data-driven IoT applications
- OBJ2. To enable self-awareness in smart city platform with programmability and dependability properties
- OBJ3. To provide libraries and tools for scalable knowledge extraction
- OBJ4. To design and assess, with citizen and end-user involvement, attractive smart city services
- OBJ5. Propose sustainable dissemination and exploitation plans and create an ecosystem of innovators (SMEs, startups, citizens, etc.) with realistic win-win business models

To ensure Obj4 is met, the project has provided a set of performance indicators which will be used to measure its progress. These are detailed in the table below:

TABLE 1 PERFORMANCE INDICATORS FOR TRIALS

Obj4. BigClouT Trials with citizen involvement		
4.1 Develop a number of viable smart city services and applications with all relevant city stakeholders	Number of stakeholders (e.g., local authority representatives, developers, citizens, SMEs and industrials) involved in service or application definition	5 per city
	Number of citizens ranking use cases by e-consultation	200
4.2 Actively involve end-users in the trial execution and evaluation	Number of trials organized per city	2
	Gather feedback from specific trials and assess sustainability	On 60% of trials

It is important to recognize that the trials are part of an overall demonstration component that begins with use case definition (WP1) and carries through to the core demonstration activities running from M8 to M36. These will take the form of end-to-end technical component integration demonstrations and also field trials based on the use cases allowing us to both monitor progress and evaluate progress against the defined KPIs. Starting from the use case definition phase, the trials will follow 3 main phases: prototype, large-scale deployment and validation. They will take place from M8 to M24 (prototyping) and from M24 to M36 (deployment and validation). To ensure the best results, cities will be actively involved in the coordination of the trials. In the EU, because the cities are full members of the project, they will lead the trials. In Japan, because the cities are not project members, they will cooperate in the coordination, fully supporting the deployment phases.

1.1   Effective real-world trials

Developing an effective trial will involve, in part, a compromise between the needs of the project, city stakeholders and potential end-users. Especially in the case where we are not paying participants to use our systems and where trial systems will be competing for attention with everyday life and its demands. By developing a formative understanding of the needs of the stakeholders, we may be more effective in shaping a trial that can be more successfully adopted.

- A trial will likely have more engagement and higher impact if it meets a genuine stakeholder need, or promises some benefit in return (e.g. an improvement in a particular service they use frequently). There is a question over the length and number of participants in each trial. Longer trials in more naturalistic experimental conditions will require greater engagement from participants, and thus more intrinsic motivation from, or extrinsic compensation (e.g. incentives).
- All participants do not have to be city residents with all their diversity and interests, we may focus on meeting a specific need of a particular demographic or group. The population might be easier to reach and impacts easier to assess and interact with (note that face to face interactions and interviews are expensive in terms of time and staff requirement).
- If the trial also meets the needs of an existing organisational stakeholder (for example), then it is also likely to piggyback on existing efforts and work in harmony rather than in competition with their otherwise potentially busy lives.

Examples of such everyday needs might be:
- Improving an everyday activity like transportation to work, or making payment simpler or less complicated for frequently used services
- Offering new smart city services based on maintaining connections from city dwellers to their remote loved ones outside the city

Fieldwork is key to understanding these needs and alignment between the trials and stakeholder interests. We could consider co-design mechanisms and focus groups to uncover the issues faced by target groups. There will already be government services and charities who are targeting known important city problems, and by working with these we will benefit from their knowledge and experience.

A brief overview of some of the key issues when considering trials is available in the document Procedure for Real World Trials (Appendix 2) available in deliverable D4.1.

1.2 Understanding the trial research goals

While it is clear that understanding end users and stakeholder needs will be important to ensure the trial meets stakeholder goals, it is also important to recognize that the BigClouT trials have a research goal. The research goal dictates the technology chosen to implement the trial, the design of the trial so that it generates the data needed to validate the hypothesis and the evaluation of the trial. It is critical that all trials designed and developed clearly identify their research goals, their methodology and their evaluation criteria. This may be simply to understand better if a BigClouT technology piece meets a certain objective, e.g. how can edge processing be used to support a particular smart city service scenario, or it could be more user focused, e.g., does the use of virtual gaming characters lead to better citizen engagement with city services.

In all cases, the trial should clearly document what the trial's research goals are, how those will be explored via the trial, how the goals will be evaluated and how the results will be communicated.

2 CORE GUIDELINES

Core guidelines are those that we think all trials *should follow*, i.e. a trial should have appropriate documentation referring to the guideline. We contrast these with *additional guidelines* (see later) that describe guidelines that projects may *optionally* follow.

It is important to note at this stage that these are guidelines and not mandated. All cities are different and the trials we plan to run have to work within a complex city ecosystem. As such, cities are the ultimate decision makers on whether they will follow a guideline or not.

2.1 Ethics

Key message: *all trials should develop an **ethics plan**, addressing the guidelines discussed below and in particular, ensuring they meet the requirements laid out in internal ethics process described in D7.1*

Each trial will raise a number of ethical issues as stakeholders are engaged, data is gathered, opinions sought and trials deployed. It is important that each trial develops an ethics process at an early stage and uses the ethics process to guide the trial and its engagement with stakeholders and end users.

Ethically, BigClouT trials should be considered '**low risk'**, since we are unlikely to be working with at risk groups, employing deceit, or conducting any form of experiment that could harm participants. Participants will be healthy consenting adults. Risk will be largely confined to

potential privacy threats to data concerning participants ('personal data') and their potential identification, and or involve 'tracking location or observation of people').

WP7 within BigClouT has already laid out initial ethics requirements - these mainly focus on the protection of personal data (PoPD). The project has an ethics committee (EC) in place that will review both the use cases and the trial plans to ensure that any issues are identified and handled correctly. The deliverable D7.1 mandates some core requirements and (will) include a discussion of data protection issues. The NICT handbook, "Private data Protection" is recommended as one of the guidelines for handling personal data.

2.1.1 Responsible Research and Innovation

The Responsible Research and Innovation (RRI) initiative has been used as general guidance for the BigClouT field trials. In particular, it's overriding ethos of " *Involving society in science and innovation 'very upstream' in the processes of R&I to align its outcomes with the values of society"* is a core foundation of BigClouT. The BigClouT ethics and engagement processes have, as a core element, 'upstream' or early public engagement to ensure that the field trials are aligned with stakeholder values and needs. One of the main BigClouT principles, stakeholder engagement, is designed to '*engage actors through inclusive participatory methodologies*' as stressed in the RRI initiative.

Equally RRI guidelines are adhered to with respect ethical processes, diversity, inclusivity, transparency and adaptability.

Lastly, BigClouT participants are encouraged to familiarize themselves with the RRI initaive and, where possible, identify aspects of RRI that manifest themselves in their core ethics, engagement and data management plans.

2.1.2 Ethical principles

We recommend the adoption where possible of the following set of ethical principles which are derived from the general guidelines of the RRI (https://www.rri-tools.eu/research-community) and as previously enumerated in the FP7 PD-NET FET-Open grant number: 244011 ethical handbook (http://pd-net.org/ethics/). Specifically, that BigClouT trials:

1. Maximize Possible Benefits and Minimize Possible Harms
2. Obtaining Voluntary Informed Consent
3. Ensuring Right to Withdraw
4. Disclosing Detriment Arising from Participation in Research
5. Providing Data Protection and Privacy
6. Limiting Disclosure
7. Following Minimal Intrusion Principle
8. Offering Adequate Incentives
9. Special Provisions for Experiments Involving Children and other Vulnerable People
10. Avoiding Deception

More details are provided in the associated project ethics primer (Appendix 1) available in deliverable D4.1.

A key requirement is to follow the internal ethics process detailed in Deliverable D7.1. In particular, each trial should provide details of:

1. *Synopsis of trial*
2. *Type of participant expected*
3. *Type of data to be collected*
4. *Ethical approvals*
   1. *Copies of ethical approvals*
   2. *Existing overall process to get these approvals*
5. *Detailed information on the procedures that will be implemented for data collection, storage, protection, retention and destruction:*
6. *Details on the procedures and criteria that will be used to identify/recruit research participants*
7. *Procedures for participant information*
8. *BigClouT project information sheet*
9. *Participant informed consent forms. Including details on:*
   1. *Details on the procedures and criteria that will be used to identify/recruit research participants must be provided.*
   2. *Detailed information must be provided on the procedures that will be implemented for data collection, storage, protection, retention and destruction and confirmation that they comply with national and EU legislation.*
   3. *Confirmation: the applicant must explicitly confirm that the data used are publicly available.*

In addition to the core ethics guidelines on data protection and participant consent, other ethics issues that should be included in the ethics process include:
- Accessibility and the digital divide. How to ensure all citizens have access to the trial, not just 'young, digital literate adults'

Note.
- The ethics guidelines discussed in this document will need to adapt to Japan side situations. Where applicable, Japan side processes, agreements and norms take precedence.
- Ethics and the EU's Responsible Research and Innovation initiative. The guidelines in this document align with the RRI. Trial partners are encouraged to review the RRI initiative and incorporate appropriate aspects into their trial plans. https://www.rri-tools.eu/about-rri

2.2 Stakeholder engagement

Key message: *all trials should develop a **stakeholder engagement plan**, addressing the guidelines discussed below and in particular, containing a participant recruitment and management section.*

A critical aspect of all trials that will be conducted by the BigClouT project is the need to engage stakeholders at all stages of the trial. It is important for both the validity of the trial and for the overall goals of the project that trials identify the key stakeholders at each stage of the trial. While this document is focused primarily on the trial phase, it is important that a trial considers the definition stage (use case from WP1) and ensure continuity of stakeholder engagement from initial engagement through use case definition, project proposal and into the project implementation and trial.

As a general guideline, BigClouT trials should follow the general process laid out in Figure 2: .

FIGURE 2: STAKEHOLDER ENGAGEMENT FROM IDEATION TO SUSTAINABLE PROJECT.

As Figure 2: shows, the process from idea to project begins with initial face to face discussion groups involving stakeholders such as users or businesses, results in ideas that are posted to an online discussion group. These ideas are then refined in workshop that aims to have groups form around idea. Once formed, groups prepare project ideas for online discussion, and then a 2nd workshop is used to prepare project proposals. These are again posted to the online forum which then form the basis of an actual project (or trial). Once a project trial is underway, sustainability workshops should be run with stakeholders to monitor progress and to begin to generate ideas with the stakeholder community of how to ensure the project continues after the trial phase is over.

A *stakeholder engagement plan* should be developed that addresses the following issues:

Identify stakeholders. Who are the stakeholders that will be involved in the trial? - stakeholders may include government (Federal, Municipal, Local, etc.), regulators, land & property developers, ICT service providers, systems integrators, utility providers, transport operators, citizens, etc. For each stakeholder describe their involvement, goals and activities during the process leading up to the trial, the trial itself and the evaluation/sustainability phase of the trial. BigClouT has committed to engaging at least 5 stakeholder groups for each trial.

Identify trials user and develop recruitment plan: As part of the stakeholder engagement plan, it is important that all trials have a clearly defined recruitment plan that lays out who are the target users, how they will be recruited to the trial (including promotion/marketing etc.) how they are engaged/motivated during the trial etc. Obviously, each trial will have different requirements depending on the nature of the plan, but the following points should be considered.

- Specify the minimum number of participants required for the trial (our proposal states we will engage 200 users in each use-case evaluation)
- Specify the target mix of participants (male/female, age, demographics etc)

- Identify mechanisms for recruiting participants. Discuss the recruitment channels and partners e.g. city stakeholders? Do we go via particular interest groups? What population or demographic make up are we interested in recruiting?
- Specify the expectations for the participants, i.e. How many engagements, how often and for how long?
  - Normally there is attrition in trials, especially over longer periods, so significance of losing participants should be considered.
- Identify the incentives for the users to participate. Is there a reward for engaging with the project, e.g. a bursary or fee/competition entry?
- How does the city promote and publicise Smart City trials to stakeholders?
- How do we continuously keep in touch with the participants, mainly in order to get feedback (any kinds: needs, feedback to the app/service, etc. etc.)
- Additionally, we should ensure that the results of the on-going evaluation and the final evaluation are fed back to stakeholders so they can see progress. A useful part of this feedback would be appropriate visualizations to communicate results.
- Resourcing plan for the trial. Outline the resource needs of the trial covering the resources needed to recruit and interact with end users, fixing bugs, gathering data (sensing, questionnaires etc), management and sharing of data etc.

Recruiting participants and obtaining informed consent is covered by the [obtaining informed consent primer (Appendix 3)](#) which is available in Deliverable D4.1

A core principle of the EU's RRI is stakeholder engagement. As discussed, early and frequent engagement is critical to responsible- and effective - research. More details can be found in https://www.rri-tools.eu/how-to-stk-rc-set-up-a-participatory-research-agenda

2.3 Evaluation methodology

Key message: *All trials should develop an **evaluation and goals** statement that outlines the goals of the trial, the project KPIs that will be met, and the evaluation methodology that will be used for the trial. A key question is whether to design an experiment or assess user experience.*

The design of the user trial and its evaluation methodology are critical to the research goals. Of particular note is the type of trial that is undertaken. For example, the goal of the trial may be primarily to assess a user experience to provide feedback on a particular service or application idea, or to test a hypothesis about user behaviour. Alternatively, it may be an experiment to measure the performance of a particular piece of BigClouT software, for example the performance of the edge computing capability of the D-NR software component. These different trials could be carried out in different ways, for example understanding user feedback may primarily come from questionnaires and surveys based on a lightweight or artificial trial, or they could come from experimentation in the lab which is extrapolated into a real-world trial, or from real world trials using a natural setting ie real world city deployments. Each type of trial has different strengths and weaknesses. (A useful introduction can be found in Wynekoop and Conger[1], See also[2])

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[1] Wynekoop, J.L. and Conger, S.A.: A Review of Computer Aided Software Engineering Research Methods. In Proceedings of the IFIP TC8 WG 8.2 Working Conference on The Information Systems Research Arena of The 90's, Copenhagen, Denmark (1990)

[2] Jesper Kjeldskov, Connor Graham. A Review of Mobile HCI Research Methods [Human-Computer Interaction with Mobile Devices and Services](#) Volume 2795 of the series [Lecture Notes in Computer Science](#) pp 317-335

In the table below, we summarize a number of different approaches to running trials (Enquiry type) and highlight the strengths and weaknesses of the different approaches.

TABLE 2. SUMMARY OF RESEARCH METHODS

Enquiry Type	Purpose	Strengths	Weaknesses
Interaction logging	Tracking interaction frequency/ time	Scales to large number of participants. Invisible to participants. Shows patterns of use.	Motivation for engagement or disengagement not captured (need observation/intervi ews). Privacy invasive.
Experience sampling	Samples non-functional or motivation 'in context'	Provides data from the field without need for direct observation	Participant inconvenience/ fatigue. Reduced return rates.
Follow up questionnaires	Sample subjective user experience	Scales to large number of participants.	Low completion rates (10% typical), depending on incentives. Self-report rather than objective measures. Needs careful design to balance.
Ethnographic observation/intervi ews	Understand how technology fits with everyday life	Rich qualitative data source. Insight into appropriation and adoption of technologies.	Small 'n' due to resource limitations. Requires skilled practitioners. Participants are aware they're observed.
Focus groups	Engage with specific stakeholder groups	Lots of information in a short and cost effective way.	Small 'n'. May have 'group think' effects. Subjective and based on opinion rather than field observation or objective measures.
Measuring application/service-specific quantitative performance indicators	Measuring how the evaluated software/applicatio n/service is performing towards the designed specific goal.	Direct data gathering	Motivation and engagement subject to end user vageries

Questions that should be considered in the *evaluation and goals statement*, which have a bearing on study, software and evaluation design include:

- What experience are we trying to measure? For which stakeholders?
- How do we go about surveying or measuring this?
- Short or longitudinal evaluation/experiences?
- Do we need to track engagement? Qualitative/quantitative metrics of engagement?
- What do we need to know about participants for our analysis/conclusions and how do we protect their privacy?
- Which parties are conducting the evaluation (are we relying on 3rd parties or self-reporting)?
- Are we looking to measure statistically significant effects or improvements?
- Technology side evaluation. What aspect of the BigClouT technology platform is being evaluated and what is the methodology used for that evaluation. See section "Technology Components and research outcomes"?
- When do we measure user's evaluation (e.g., satisfaction)? (probably both before and after the experiment, in order to compare the satisfaction of the end users)
    - Also, related to this, 2 evaluations "before" and "after" need to be the same evaluation in order to compare the results. Thus, we need to carefully design the evaluation before the actual experiment starts.

Careful thought needs to be given to the evaluation methodology as it drives the overall way that the experiment will be designed and carried out. This requires that early planning is needed, even at the use-case stage so that the role of the use-case is clear in the overall evaluation. Failure to carry this out in the early phase of the project is likely to result in use-cases and therefore experimental trials that are interesting in their own right, but provide no useful data on the value of the BigClouT technologies as a framework for smart city services and applications.

2.4 Data gathering (technical)

Key message: *All trails should develop a **data management plan** describing data that will be captured, its format and how it will be managed. Additionally, details of what data sets will be shared using the BigClouT data repository should be provided.*

The ethical issues of gathering data from and about users is discussed in the Ethics section (Above). This section is focused on the technical aspects of data gathering with a goal of ensuring that all project partners can access and use data. Since the exact nature of the trials is still under definition, this section provides some general guidelines. Once the trials have been specified, the relevant sections will provide more concrete statements about the trial data gathering.

We should take care to understand the "story behind the data" that we use. Data is often partial and may be intentionally or unintentionally biased or selective.
What data do we need in order to capture the effects of the trials or interventions?

- Types of data
    - Is this qualitative or quantitative data?
    - What scale of effect are we trying to observe and what is the size of the effect we are trying to measure?
    - Careful consideration needs to be made of the challenges of collecting data (especially qualitative interview or experience data) at scale?
- Format of data

- Guidelines on types of data to be gathered, e.g. user data, usage data, technology performance data etc.
- How to share data between partners/sites – all projects should identify the data sets they will collect at the use-case and trial stage and should indicate how they will make those available to other project partners.
- Data formats – do we want to adopt some common data formats so we can easily share data, eg XML, JSON, others? A challenge in smart city projects are the bespoke formats of data, which makes comparability across trials and cities difficult. Open data formats should be adopted, if possible. We should be clear on what we need to compare across trials/cities.
- Management of data
  - Roles, keys and credential management for accessing data without violating ethics
  - Suggest we create a data management plan (if that's not in this document) so there is clarity on how we handle data/sensitive data for the project.
- Curating data after project end
  - The data management plan for each trial should specify how data is treated at the end of the project, including which data is disposed of, and which retained as a project output.
  - Data retention should be observant of recruitment protocol agreements, and the sensitivity of the data (e.g. only anonymised data is suitable for publication that does not reveal personally identifiable information)
  - Should we include a plan for after the project?

The secure handling of data to minimise risk and privacy violations is also discussed in the document "Guide to secure data storage" provided as Appendix 4.

Lastly, the EU's RRI initiative has a useful tool to help in developing data management plans, see https://www.rri-tools.eu/-/dmponline-data-management-plan-online

2.5 Technology components and Research Outcomes

Key Message: *All projects should provide an indication of BigClouT technology components and infrastructure they plan to exercise in the trial and how this helps meet the 5 core objectives of the project.*

As discussed earlier (Sec 2.1), it is important to recognize that the BigClouT trials have a research goal. The research goal dictates the technology chosen to implement the trial, the design of the trial so that it generates the data needed to validate the hypothesis and the evaluation of the trial. As discussed in the evaluation methodology section (Sec 3.3) it is critical that all trials clearly identify their research goals, their methodology and their evaluation criteria. Part of that evaluation criteria is an evaluation of the use of the core BigClouT platform and its underlying technology component.

Returning to the core objectives of the project:

- OBJ1. To build an interoperable architecture enabling data-driven IoT applications
- OBJ2. To enable self-awareness in smart city platform with programmability and dependability properties
- OBJ3. To provide libraries and tools for scalable knowledge extraction
- OBJ4. To design and assess, with citizen and end-user involvement, attractive smart city services

- OBJ5. Propose sustainable dissemination and exploitation plans and create an ecosystem of innovators (SMEs, startups, citizens, etc.) with realistic win-win business models

Each trial should indicate which of core technology objectives it is exploring (Obj1-3) and which specific technologies it is using.

- During use case development, it would be helpful to identify potential components exercised
- Projects should report on the experiences using technology components as part of the final trial analysis/report

3 PLANNED TRIALS – USE OF GUIDELINES

In this section, we provide details of the planned trials of the four pilot cities of the project: Grenoble, Bristol, Fujisawa and Tsukuba, We outline how they have used the trial guidelines in this document for initial planning, discuss their ongoing engagement activities and highlight any lessons learned from initial trials that are being fed into the plans for future trials

3.1 Bristol: Trial 1 Smart Energy

• **Synopsis of trial**

This trial is about exploiting BigClouT's novel data-adaptive machine learning techniques for predictive analysis and the power consumption of users. The trial will reuse the infrastructure installed by the European project REPLICATE project (http://replicate-project.eu/).

REPLICATE will be retrofitting a selection of Bristol's homes with smart white goods, which will be connected to a city-wide ICT Platform. The trial will then exploit the consumption data from Bristol citizens.

FIGURE 3: BRISTOL: SMART ENERGY OVERVIEW

In Figure 3 we provide a general overview of the trial architecture which builds on the FIWARE platform and the Orion broker. Devices connect to the platform over a variety of communication

services such as LoRa or 4G networks and use the backend device management systems (IDA) of FIWARE for device management. Finally data is communicated to other instances of the BigClouT platform using the FIWARE NGSI interface.

3.1.1 Ethics plan

- **Type of participants expected**

The participants within the REPLICATE pilot are recruited through Bristol Energy's ' Warm Up Bristol' initiative. The trial will only be available to occupiers of council rented properties within three selected wards of Bristol City Council area.

- **Type of data to be collected**

Electric consumption and environmental data will be collected from the smart white goods installed into the homes of Bristol citizens. No other type of personal identifiable information will be collected.

- **Ethical approvals**

The Bristol City Council will have implemented their own ethical procedures to ensure the safety of the citizens involved. BIO need to ensure we are compliant with data safety legislation during the deployment process as a data 'processor'. This is currently being defined by BIO management staff.

- **Details on the procedures and criteria that will be used to identify/recruit research participants**.

For recruitment of participant households, we will utilise the existing Warm Up Bristol recruitment campaign with involvement of KWMC (Knowle West Media Centre) to carry out targeted recruitment of one hundred and fifty residential participant households clustered in the specified demonstration district. This will link into the citizen engagement and involvement actions. The process will consist of:

- Survey of properties to address feasibility of homes for the retrofitting. (Bristol Energy Service)
- Calculating cost of installations (Bristol Energy Service)
- KWMC Producing combined collaterals (subject to workshop)

- Ethics summary

Ethics issue	Importance (H/L)	risk (H/M/L)	status
Ethics plan documented	H	L	Engagement with the public will be coordinated by Bristol City Council within the REPLICATE project. Ethics plan put in place for stakeholder engagement activities planned.
Informed Consent	H	L	The REPLICATE project will recruit members of the public. The recruitment process will require an agreement to be signed between Bristol City Council and the volunteers. Prior to engagement with stakeholders an agreement will be drawn up to ensure they understand their input and any associated risks.

Disclosure	L	L	Citizens who are recruited by the REPLICATE project as part of the agreement in place will require to disclose some information to the council, but this will not be accessed by BIO. Stakeholders engaged during the use case i.e. BCC will be made aware that the information they provide may be disclosed to other parties and should they wish can ensure this remains private but will still be used in defining the use case.
Data security	H	M	Only anonymised data will be held during the course of the use case. However BIO is ensuring that it is compliant with GDPR prior to the integration with the smart white goods and the IOT platform.

3.1.2   Stakeholder engagement plan

•   **Specify the minimum number of participants required for the trial**

REPLICATE will install at least 150 Home automation units in different houses around the city, so it can be said that 150 will be the minimum number

•   **Specify the target mix of participants (male/female, age, demographics)**

According to the REPLICATE project, Bristol will contract works via its Warm Up Bristol contractor framework in the retrofitting of 150 residential buildings in Easton and Lawrence Hill Neighbourhood (See Figure 4).

FIGURE 4: BRISTOL: SMART ENERGY TARGET RECRUITMENT AREAS

It is not an individual personal experiment, because it is based on the occupants of the whole house and based on the demographic information provided by the city council, we can estimate that:

- Age from 0 to 15: 25%
- Age from 16 to 64: 67%
- Age from 65 or older: 8%

Related to the gender it can be said that the male/female distribution is around 50%. This sample of Bristol's population is typical of the demographic of Bristol City Council's local authority area. Bristol has a relatively young age profile, with more children under the age of 15, than citizens of a pensionable age. There is a roughly equal split between genders of 50% in the city council area. The areas selected in the use case have a large population of working age adults which is typical of the wards surrounding the city centre. Within the area there is also a large growth in population, as experienced in 3 other central areas of Bristol [16].

- **Identify mechanisms for recruiting participants. Discuss the recruitment channels and partners**

We are going to reuse the sensors from the REPLICATE project, so the participants will be the residents who have already signed up for the scheme and have collected relevant household information

•The process will consist of:
- Survey of properties (Bristol Energy Service)
- Calculating cost of installations (Bristol Energy Service)
- KWMC (replicate specific products) Producing combined collaterals (subject to workshop)

- **Specify expectations for the participants, How many engagements, how often and for how long?**

Once the sensors have been deployed in the selected homes, no more interactions would be needed from the participants, because this research has been designed for to be a non-intrusive pilot. It would be constructive to the BigClouT project if we were to engage with the citizens throughout the process, however due to the restrictions in engagement on the REPLICATE project we are now proposing that we will engage with those stakeholders leading the project and the initial recruitment process, to ensure that we do receive constructive feedback on the trial. These stakeholders will include;
- Warm Up Bristol
- Bristol City Council
- Knowle West Media Centre.

Our engagement with these stakeholders will be on a quarterly basis throughout the deployment period. We will meet and discuss the progression of the deployment and provide feedback on these interactions through a series of logs.

- **Identify the incentives for the users to participate**

Within this use case we will now have to differentiate between the users participating in the pilot and the stakeholders we will be engaging with throughout the deployment process.

The Bristol citizens involved in the REPLICATE project, will be able to view their current energy usage and will receive suggestions on how to reduce their energy usage and cut down on their electric bills.

The stakeholders we are engaging with who are making up the Bristol pilot for REPLICATE will be able to provide feedback to the development of this use case. The smart energy use case will provide them with a progression of the current REPLICATE project. The REPLICATE project will

have an Open Data platform for the data to be viewed by members of the public. However, this data will also feed into the BigClouT platform providing further big data analytics

3.1.3   Data Management plan

We are in the process of starting the pilot design in collaboration with the Bristol partners. The pilot design will incorporate a data management plan. In collaboration with the other Bristol stakeholders, we will be ensuring that we will be compliant with the EU General Data Protection Regulation (GDPR) from May 2018. This is critical for the success of the project and will be incorporated into the deployment plans for this use case.

It is planned that the data will be collected and aggregated in a dedicated IoT middleware deployed inside the Bristol is Open Cloud using different platform assets such as OpenStack Keystone. Data will also be isolated from the Internet by two firewalls and public key cryptography.
Data will be available and accessible through the BigClouT data repository via a RESTful API via HTTP. Its purpose is to exchange context information.

- **Describe the data that will be collected by the trial**

The data collected will be power consumption from white goods, and environmental information. Other personal identifiable information may be collected by the project collaborators for research purpose but will not be applied in the BigClouT data repository.

- **Describe the formats and how the data will be stored**

Mainly the data will be available in JSON format which is a lightweight data-interchange format easy to read and write, completely language independent and simple for machine to manipulate and process.
The collected data will be aggregated and stored in a dedicated database which will be populated via the BIO smart city platform sitting between the BigClouT data repository and the data sources represented by the multiple manufacturer/vendor cloud(s).

- **Will data be available into the BigClouT data repository/warehouse**

The main aim is placing the collected data into the BigClouT data repository by using a specific BigClouT technology which in this use case is node-RED.

- **Will data be kept after the trial ends – provide details**

Yes, until end of project lifetime. Afterwards it will be removed.

3.1.4   Goals of trial and experimental methodology

- **Goals of trial**

 The objective of the trial is to make householders aware about different phenomenon, that otherwise would have a very difficult detection like 'the phantom load' also known as 'vampire power' which is quite difficult to detect and hard to monitor for citizens. Giving the picture of the overall consumption to the householders would help them to better identify time and ways to save electricity. This will not only affect the householder's pocket, but electricity is very often

generated by combustion of hydrocarbons (oil, coal, gas) or other substances, which releases substantial amounts of carbon dioxide, implicated in global warming, and other pollutants such as sulphur dioxide, which produces acid rain. So in the reduction of their energy usage the user is helping to reduce gas emissions.

- **How will data gathered help you meet the goals**

The data gathered will give evidence of the electricity consumed by electronic and electrical appliances while they are switched off (but are designed to draw some power) or in a standby mode. This consumption may be of the order of 10% of the electrical energy used by a typical household.

- **What is the evaluation methodology**

This is still under definition for the citizens participating in the REPLICATE pilot. It is expected that this will involve additional stakeholders i.e. energy provider to see if there has been a reduction in consumption within the households.

The evaluation will need to incorporate both quantitative and qualitative analysis. Statistical analysis can be carried out on the data provided from energy consumption trends over the introduction of the white goods. Qualitative feedback will also be required from the Bristol stakeholders (not the citizens), to identify if they have identified secondary effects from the introduction of the pilot. The evaluation methodology will need to incorporate feedback from the following stakeholders;

- Bristol Citizens involved in the trial. Has there been a reduction in their electricity bills.
- Bristol Energy (as the energy provider to the area). Have they noticed a large uptake in the reduction on energy consumption within the area.

Further evaluations will need to incorporate evaluations on the technology. Many of the partners involved within this use case are not technology focused. BIO will lead this evaluation to identify the improvements that could be made to the architecture.

- **What is the risk mitigation strategy**

BIO will identify the risks within the deployment, which may be identified by our Bristol partners during our interaction sessions. This will be logged by the Project Manager supporting the lead engineers, and an owner will be assigned to the risk to ensure this is managed appropriately. Due to the dependency on the REPLICATE project, the lead engineer working on this use case will also be leading on REPLICATE to ensure risks are identified which may affect the development of the smart energy use case.

KPI or metric	Target	Status	WP1 linkage
Number of households involved in trial	150 min	Householders are currently being recruited from the REPLICATE project. 150 smart meters will be installed to record energy consumption.	R1.2.19 R1.2.21 R1.2.25 R1.2.26 R1.2.29
Representative demographics	Trial participants should represent household	The demographics within the recruited area does correspond with the demographics of the Bristol city area. Bristol City Council will have access to the full list of demographics,	

	demographics of Bristol city area	however BIO would prefer to have the statistics on the users rather than the full set of demographic data to protect their own data.	
Daily active users	150	There will be 150 minimum users in the use case however this may not be the minimum number of daily active users due to work patterns, and holiday schedules of those involved.	

3.1.5 Ongoing engagement

• **Details of ongoing engagement as initial work has begun**

BIO has been planning the initial engagement with the Bristol Partners; Bristol City Centre, Bristol Energy and Knowle West Media Centre. We have been interacting with Bristol City Council regarding their initial interactions with the citizen recruitment process and engagement.

Going forward BIO will be interacting with Bristol Energy and Knowle West Media Centre to remain up to date on the initial citizen recruitment process.

BIO will be interacting with Bristol City Centre to ensure the technical deployment is carried out according to their specific necessities for the energy platform. This is an ongoing engagement and will continue throughout the lifetime of the project.

3.1.6 Lessons learnt

• Details of lessons learnt from the ongoing engagement, from feedback from stakeholders and from any initial trial activities

- There are limitations on BIO to engage with the users which may restrict the feedback that we will receive from the pilot. This is due to the policy within REPLICATE to not engage with citizens once they have been recruited.
- There are dependencies on the REPLICATE project which need to be monitored to ensure the success of this use case within BigClouT. This will be monitored by BIO managers and engineers. The issues considered which BIO are managing are identified below;
  - REPLICATE Project Managers delivering an on-time vendor process for the white goods. Bristol are liaising with REPLICATE PM's to ensure that the vendor process is on time and in accordance with the timeline of the use case deployment delivery date.
  - Bristol working with other REPLICATE partners to deliver on the development of the ICT City platform which will be interconnected to the BigClouT platform for this use case.
  - Ensuring that the data in the REPLICATE project is compliant and remains open so the data is viable to be used on the BIO and BigClouT infrastructure.

3.1.7 BigClouT Technologies used

• **Detail the BigClouT technology components that will be used by the trial**

The Smart Energy use case will be operated on the BIO Smart City platform that is ICT platform mainly providing smart city network infrastructure in Bristol, software defined network adaptive layer, EDMS. An IoT middleware solution uses Node-RED/FIWARE to collect and aggregate power consumption data from multiple-vendor smart white goods in the trial houses, and finally place into the BigClouT repository by using CKAN.

3.1.8 *Use case requirements analysis*

• **Explain which use case requirements the trial supports and indicate % coverage of the use case**
-The minimum number of participants required for the trial is equal to 200 and the actual number of participants is attested around 150 units so the percentage of coverage within the use case is around 82.5%
- The procedures and criteria used to identify/recruit research participants is supported within the use case and realised via the existing Warm Up Bristol recruitment campaign. The entire number of participants comes from this campaign which targets more deprived areas of the city.
  -With regard to the expectations for the participants, since this use case has got a dependency with the REPLICATE project which has not planned a continuous engagement with the participants, we can state that this specific requirement is not met within the BigClouT Smart Energy use case. Nonetheless BIO has got a plan in order to engage with other Bristol Partners considered as key stakeholders. In this case we hope to cover the requirement going over the 65%.
-Main incentive for the users to participate is basically represented by the lowering in power consumption, hence lower charges for electricity bills. Quantifying a percentage matching this specific requirement within the use case it is not possible since the trail has not started yet.

3.2 Bristol: Trial 2 Smart Mobility Trial

• **Synopsis of trial**
Bristol Is Open (BIO) will deploy a set of air quality sensors around the buildings of the University of Bristol and/or Bristol city offering to pedestrians a service which will identify the healthiest path within the city to follow. The overall system architecture is show in Figure 5 and uses similar technical components to trial 1 (see explanation for Figure 4).

3.2.1 Ethics plan

• **Type of participants expected**

The participants in the use case will be commuters and tourists within Bristol City Centre, specifically around the University area of Queens Road.

• **Type of data to be collected**

The types of data involve air quality such as PM2.5/10, O_2, O_3, CO_2, SO_2, NOx, noise level, etc., as well as ambient sensing such as weather, temperature, humidity and luminosity, etc. This will then identify a 'healthier and safer' route to travel along for citizens.

• **Ethical approvals**

The University's Ethics Policy and Procedure governs the ethics of research across the University of Bristol. It applies to all staff, students and anyone else carrying out research under the auspices of the University. All research that has ethical implications or involves human participants, their tissue and/or data must have an ethical review.

• Ethics summary

Ethics issue	importance (H/L)	risk (H/M/L)	status
Ethics plan documented	H	L	An ethics plan is being collated as University Staff and the public will be involved in the engagement for this use case. BIO is in discussion with the university regarding their protocol for involving staff in research projects.
Informed Consent	H	L	Citizens and UOB staff will be made aware prior to the engagement process that their feedback will form the development of research use cases towards smart cities. BIO will explain the research and any potential risks prior to the engagement commencing.
Disclosure	L	M	Citizens and UOB staff will be made aware that the information they disclose will go towards developing research use case however any information they wish can remain private and will not be shared with the public or BigClouT consortium.
Data security	H	M	The data that will be collected will be on environmental factors. Those members participating in engagement activities will have to disclose their age and sex to ensure we are reaching the correct demographics for the use case. However, this data will be anonymised and will be destroyed after the feedback has been reviewed.

• **Details on the procedures and criteria that will be used to identify/recruit research participants.**

The involved research participants will be Bristol Citizens commuting within the area where the sensors will be deployed. Once the use case has been deployed they will not be directly recruited by BIO staff but will benefit from viewing the data that promotes healthier and safer routes for them to commute by.

The stakeholder engagement plan will look to recruit citizens who are commuting within the area, and they will be engaged for feedback on the proposed use case during the hours of 8-9am and 4-5.30pm, this should cover the key commuting hours. It is expected that they will be citizens who have either travelling to work through different modes of transport but primarily walking into the city centre for working hours. They will be observed and asked to participate in an interaction with BIO staff to understand their motivation behind their travel route. This interaction will be a non-structured interview style which should allow BIO staff to explain the concept of the use case and gain their feedback.

The engagement plan will also incorporate discussion groups with university staff members who are commuting within the area. BIO will explain the concept of the use case and ask stimulus questions to the reasoning behind commute paths and potential considerations BIO may need to develop the use case and user interface design.

All interaction during the stakeholder feedback will be anonymised. We hope to recruit participants of a working age with an equal mixture of female and male participants.

• **Specify the minimum number of participants required for the trial**

There is no defined number of participants within this use case. However we would aim to collect a minimum of 150 participants.

• **Specify the target mix of participants (male/female, age, demographics)**

The use case will mainly target users of adult age 18-55, who are commuting within the city centre for work. This will be a mixture of male and females. It is expected that there will be a large uptake of students within the area.

• **Identify mechanisms for recruiting participants. Discuss the recruitment channels and partners**

BIO will recruit users who are commuting on foot in face to face interactions in order to provide feedback to the use case development. We will also engage with University departments to organise discussion groups for those staff and students commuting to the university within the chosen area.

• **Specify expectations for the participants, How many engagements, how often and for how long?**

We expect to engage with the users on several occasions as detailed below.

- 2 x discussion groups with staff and students commuting into University locations

- 2 x face to face 'ethnographic/observation' sessions ran by BIO staff in the vicinity where the air quality sensors will be deployed.

• **Identify the incentives for the users to participate**

Users will benefit if they know the real time and the historical records about the healthiest route to take. Users could for example, decide the place to have lunch outside or not depending on the level of air quality and pollution in the area.

Institutions based on serving the citizens, like the city council (i.e. planning the road maintenance in off peak times) or the waste collection service, could use this data for improving their services (i.e. adapting the street sweepers and cleaner's hours), which will improve the citizen life.

3.2.3   Data Management plan

It is planned that the value of the data will be stored in a dedicated FIWARE instance deployed inside the Bristol is Open cloud, potentially it will be secured by OpenStack Keystone. Anonymization (i.e. hashing) will be done during data acquisition, to protect it. Data will be isolated from the internet by two firewalls and Public key cryptography.

Data will be available through a FI-WARE version of the OMA NGSI 10 interface. It is a RESTful API via HTTP. Its purpose is to exchange context information.

Compliance with current legislation for data protection will also be met by BIO as a data processor. This is still being defined but will be in place within the second quarter of 2018.

• **Describe the data that will be collected by the trial**

We are going to detect and measure the concentration of carbon monoxide (CO) in the air as main pollutant. Also, we will have a measure related to the temperature, humidity and light level which will be processed along with the pollutant concentration

• **Describe the formats and how the data will be stored**

All data are available in JSON format which is a lightweight data-interchange format easy to read and write, completely language independent and simple for machine to parse and generate. Also, the collected JSON data are stored in a dedicated database which gets populated via a specific FIWARE instance which is able to collect data from the sensors.

• **Will data be available into the BigClouT data repository/warehouse**

The main aim is placing the collected environmental data into the BigClouT data repository by using a specific BigClouT technology which in this use case is node-RED.

• **Will data be kept after the trial ends – provide details**

It is expected that data may be kept after the trial as historical record of the air quality within the area in the BigClouT data repository.

3.2.4   Goals of trial and experimental methodology

• **Goals of trial**

The main goal is to improve the air quality that pedestrians are breathing during their routes.

• **How will data gathered help you meet the goals**

The idea is giving to pedestrians the possibility to choose a "green" path (which basically means a less polluted path) instead of a "red" path (which is the most polluted) by using LEDs screens placed in the middle of potential turning-points.

- **What is the evaluation methodology**

BIO will be undertaking evaluations of the use case with citizens commuting within the area. This will be during the deployment process in order to guide the use case and ensure we gain constructive feedback.

The best approach we believe is to undertake ethnographic and observational interviews with those citizens commuting within the area. This will be done during the deployment process, and will focus on the decision-making process of users for their routes to work i.e. less cars, more visually appealing.

We expect to gain some statistical evidence after the deployment process through questionnaires on the effect of the use case on citizens lives. These questionnaires will be structured differently to the ethnographic questionnaires we will be using during the ethnographic interviews.

- **What is the risk mitigation strategy**

BIO will identify the risks within the deployment, which may be identified by our Bristol partners during our interaction sessions. This will be logged by the Project Manager supporting the lead engineers, and an owner will be assigned to the risk to ensure this is managed appropriately.

KPI or metric	Target	Status	WP1 linkage
Target user number	150	Locations for one large LED screen has been identified in Millennium Square where there is a large footfall of commuters who can use the data to form their plan. Expected to reach 150 target users with this alone.	R1.2.20 (Add collecting air quality information) R1.2.29 R1.2.31
Critical mass of users	300 in first year	In discussion with the LED screen owners to ensure that the data can be displayed here at a minimum of 12 months. Development of front end system displaying information is being explored. With the correct marketing this should reach 300 people within the first year.	
Daily active users	150	Expected that this number will be reached once LED screen and front end system in place.	
Demographics	Representative of general Bristol city	BIO will need to undertake further engagement around the LED screen and on the	

		front end system to collect information on the demographics of users. This information will not be stored permanently and will be anonymised.	
User engagement	Min 25% users respond to questionnaire	It is expected at this point in the use case that we should reach a minimum of 50 users to provide feedback on the use case. We do hope to increase this number throughout the course of the deployment of the use case.	

3.2.5 Ongoing engagement

• Details of ongoing engagement as initial work has begun
BIO is currently planning the initiation of the ethnographic interviews and the discussion groups at the University. BIO project managers will be liaising with University staff to ensure the ethical compliances are met before this is undertaken.

3.2.6 Lessons learnt

• Details of lessons learnt from the ongoing engagement, from feedback from stakeholders and from any initial trial activities
Lessons learnt already are outlined below;
   • This trial is still under development so no specific lessons are available at this stage. The will be reported in the final trial evaluation.

3.2.7 BigClouT Technologies used

• **Detail the BigClouT technology components that will be used by the trial**
In the Smart mobility use case we collect environmental information from air quality sensors which are then directed to a dedicated instance of the FIWARE IoT Platform. After that, we still use node-RED to manage the dataflow wiring our back end (or an API which represent an abstraction of it) to the BigClouT Repository (CKAN based).

3.2.8 Use case requirements analysis

• **Explain which use case requirements the trial supports and indicate % coverage of the use case**
-With regard to the minimum number of participants, we defined as a minimum number of participants to 150. The stakeholder engagement plan aims to collect feedback from commuters within the area of the air quality sensors, and from university discussion groups. BIO is limited to

the number of staff who can lead the engagement, but we hope to have coverage of 65-70% of the minimum number of participants proposed.

-We will target an equal mixture of female and male participants as it is assumed different genders will determine their routes on different factors i.e. safety. Those under the age of 18 will not be targeted as it is expected they will not be of full-time working age, however students over the age of 18 will be targeted, as it is expected they will commute to study.

- The use case should provide usable service for commuters to identify safer and healthier routes. However, it is limited to locations where the sensors will be deployed. This won't be in a large deployment area across Bristol, but should target a large group of users, as the city centre of Bristol where the proposed locations is a popular commuting area.

- The use case will provide air quality data to be extracted to the BigClouT platform. This should provide the data to identify the 'safest and healthiest' route through the area. However, the use case does not provide data to show the impact of the air quality displays to citizens i.e. how many use the signs to determine their route.

3.3   Fujisawa: Trial 1 Participatory Sensing

•   Synopsis of trial

This trial aims to experiment with the BigClouT advantages for involving people in city sensing - often referred to as user-in-the loop sensing or participatory sensing. Especially, we perform two trials for two group of people - city administrative officers and citizen. Each group has each own character and issues to be solved for involving them to the city sensing. We explain each trial as following:

1) MinaRepo - Leveraging city officers as sensors

The purpose of first trial is based on two questions -

1. can BigClouT platform improve daily city operation? and
2. can BigClouT platform collect comprehensive city data to better understand the city?

City officers have daily works, for example garbage collection, road management, environmental management, etc. In those works, they have to collect/share city information. Currently, city staffs usually use legacy technologies such as telephone or FAX to collect/share such information. However, using such old technologies is not the best way for collecting/sharing information. It is sometimes inefficient and information is not stored as analysis-ready format (they usually use paper document to store the information). In this trial, we enhance their daily work more efficiency, and combines with city sensing opportunity.

By integrating their daily works with city sensing, large amounts of useful data can be collected every day. We call such piggyback sensing on the daily work of city employees

FIGURE 6: FUJISAWA: OVERVIEW OF MINAREPO SYSTEM

Expert Crowd Sensing. In addition, city employees are expected to have more task specific knowledge of the city in which they are working than general residents. For example, garbage collectors, who daily travel through their assigned area, should be knowledgeable about the whole area and could detect subtle changes in a city. Consequently, expert crowd sensing enables us to acquire more accurate human sensing data with greater sensitivity. To achieve expert crowd sensing, a sensing tool must satisfy the following requirements:

-Easy integration with the daily responsibilities of city employees: To enhance their daily work by such sensing, the tool must not disturb their current daily activities and must efficiently support them.

-Easy usage: Since most city employees are not information technology experts, our tool must be easily understood and simply leveraged.

-Providing reliability, dependability, and security: The tool must be used in daily city functions, which sometimes provide critical services for citizens. Reliability and dependability are also needed for it. Since city tasks often deal with the private data of citizens, data must be securely protected.

We implement a system called MinaRepo to fulfill the above requirements by using BigClouT platform. As shown in the Figure 6, in MinaRepo, city staff possess smart devices. When they find city information they wish to share among other officers, they open MinaRepo application and take a photo of the information. Then, they post the report with some explanation to MinaRepo server. Finally, city officers can recognize latest city information and make a plan to deal the information (if necessary). We have tested a first prototype of MinaRepo with garbage section in Fujisawa city. In the second year, we plan to provide MinaRepo to further sections, and/or even other cities such as Chigasaki city or Samukawa city. By collaborating with other cities, we evaluate MinaRepo's advantage more clearly.

2) Lokemon - Leveraging citizens as sensors

Second trial focuses to involve citizens as sensors. When attempting to use citizen to act as sensors, there are other requirements compared to city staffs' crowdsensing, as follows:

- Privacy: Users who are participating in sensing send information to each Point of Interest (PoI). As a result, the system knows where they are at particular times.

- Motivation: It is important to give an incentive because getting involved in crowd sensing is a burden on users. Without adequate incentive mechanisms, most users may not want to participate.

-Quality of information: It is possible to allow users to contribute information anonymously to protect their privacy. However, such information may lead to difficulties such as deterioration of quality (false information), ravage and allegations of libel and slander.

In this field trial, we implement a system called Lokemon based on BigClouT platform, and show the Lokemon can be used for crowdsensing by citizens.   The basic idea of the Lokemon is very simple: users can achieve crowd sensing as monsters, which are virtually located at each place of interest. Figure 7: shows a comparison between the typical crowd sensing model and the Lokemon model. In the typical crowd sensing model, users usually use their user names (real names or pseudonyms) to send sensing data. In Lokemon model, by contrast, users send sensor data in the name of a nearby Lokemon virtually located at each sensing.
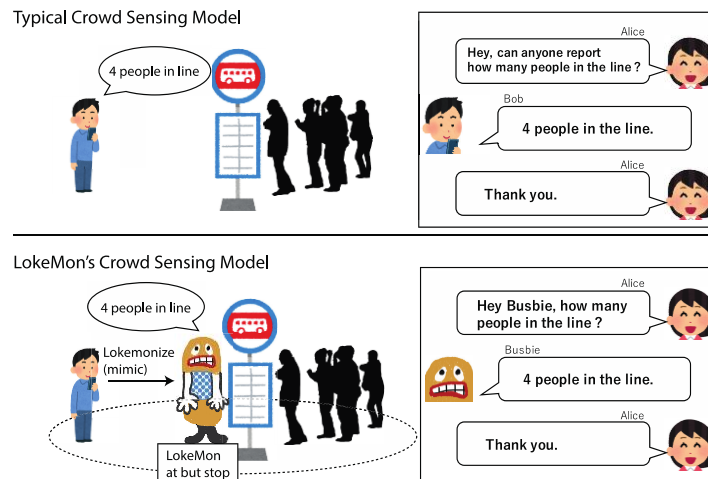
FIGURE 7: FUJISAWA: COMPARISON TYPICAL CROWD SENSING AND LOKEMON'S CROWD SENSING

Lokemon enables users to perform the following actions:
1. collect a Lokemon by visiting a place where it virtually lives,
2. use a Lokemon as an alias to report information near to its site, and
3. ask a question remotely of a collected Lokemon.

The scenario suggests solving the three aforementioned issues as follows:

- Privacy: Since the users can send data in the name of Lokemon, other users cannot know who is actually reporting the data. This reduces the chance of loss of privacy.

-Motivation: Lokemon also uses gamification techniques such as collection, ranking or cooperation functions to motivate the users. The gamification techniques motivate the users' participation. In Lokemon, people can help others without revealing their identity. This can satisfy people's voluntary kindness for others without them being regarded as 'meddlers'. Lastly, some people get pleasure from acting as a Lokemon. These strategies may enhance the spontaneous motivation of the users to participate in crowd sensing.

- Quality of information: Using Lokemon, people can concentrate on achieving the task of reporting information from that particular location. Also, since each Lokemon character has a visual design, reported information and/or people's behavior might be controlled with the design. With Lokemon, we have carried out a field trial to confirm i) is Lokemon useful for getting city information from citizens, and ii) does Lokemon change citizen behaviour. We especially collaborate with some events in Fujisawa city, for example local festival.

3.3.1 Ethics plan

- Type of participants expected:
  MinRepo: City staffs
  Lokemon: Citizens
- Type of data to be collected
  MinaRepo: city incidents which used for daily city management
  Lokemon: city event information, current situation of each places
- Ethical approvals
  NICT approval is needed for any trials. Types of collected data (users' messages and collected Lokemon information by users) and how to store/share the data (store in Keio University's database and share Fujisawa data among BigClouT partners) has approval been received, status, any issue etc.

- Details on the procedures and criteria that will be used to identify/recruit research participants.

MinaRepo: communicating with several divisions and stakeholders in Fujisawa city. Identifying their problem and propose MinaRepo to solve the problems.

Lokemon: communicating with event organizer, and getting permission to reveal Lokemon field trial information in their website, handouts and posters.

- Ethics summary

Ethics issue	importance (H/L)	risk (H/M/L)	status
Ethics plan documented	H	L	Documented in each phase
Informed Consent	H	L	Providing policies in apps, continuous communication with stakeholders
Disclosure	L	L	Providing data via WEB viewer
Data security	H	L	Direct data access is prohibited.

3.3.2 Stakeholder engagement plan

- Specify the minimum number of participants required for the trial
  MinaRepo: 20
  Lokemon: 100
- Specify the target mix of participants (male/female, age, demographics)
  MinaRepo: male and female, ages between 20-60.
  LokeMon: male and female, ages between 10-60.
- Identify mechanisms for recruiting participants. Discuss the recruitment channels and partners

MinaRepo: communicating with several divisions and stakeholedrs in Fujisawa city. Identifying their problem and propose MinaRepo to solve the problems.

Lokemon: communicating with event organizer, and getting permission to reveal Lokemon field trial information in their website, handouts and posters.

- Specify expectations for the participants, How many engagements, how often and for how long?
  MinaRepo: All working days in every week. Any city incidents related to MinaRepo should be reported by MinaRepo.
  Lokemon: every 15 minutes during event is on-going.
- Identify the incentives for the users to participate
  MinaRepo: More efficient work, quick problem solution
  Lokemon: pleasure for collecting monsters, mimicking as monsters.

3.3.3   Data Management plan

•   Describe the data that will be collected by the trial

MinaRepo: type of report, date, report username, photo, GPS location, description of report. Questionnaire survey will be also performed several times.

Lokemon: message, username, photo. Questionnaire survey will be also performed several times.

•   Describe the formats and how the data will be stored

MinaRepo: communicated via XML format (XMPP), stored as MySQL DB format

Lokemon: communicated via json format(websocket), stored as MySQL DB format

•   Will data be available into the BigClouT data repository/warehouse

MinaRepo: some data can be available

Lokemon: some data can be available

•   Will data be kept after the trial ends – provide details

MinaRepo: will be kept. No personal data. All infrastructure data stored in Keio's database without access from network outside of Keio University.

Lokemon: data will not be kept

3.3.4   Goals of trial and experimental methodology

•   Goals of trial

MinaRepo: is it possible to provide efficient work model for city staffs? Is it possible to understand new city features with collected data?

Lokemon: is it possible to get much city information by citizen? Is it possible to monitor/change people's behaviour?

•   How will data gathered help you meet the goals

MinaRepo: collected data can provide opportunities to analyse city features. Questionnaire survey is used to understand whether MinaRepo improves their daily works.

Lokemon: collected data can provide opportunities to analyse citizen's way of usage. Questionnaire survey is used to understand whether Lokemon works or not.

•   What is the evaluation methodology

MinaRepo: statistical analysis of collected data, questionnaire survey.

Lokemon: statistical analysis of collected data, questionnaire survey.

•   What is the risk mitigation strategy

MinaRepo: device/network preparation issues for city staffs

Lokemon: way for application distribution

KPI or metric	Target	Status	WP1 linkage
Users	MinaRepo: 20 Lokemon: 200	MinaRepo: 25 Lokemon: 150	R1.2.51
Critical mass of users	300 in first year	175	R1.2.52-53
Daily active users	150	30	R1.2.52-53
Average length of time spent using app	10 minutes	5 minutes	R1.2.52-53
Frequency of use	Every working day	Every working day	R1.2.52-53
Time until report resolved	1 hour	Not yet analysed	R1.2.54-58

3.3.5 Ongoing engagement

• Details of ongoing engagement as initial work has begun

MinaRepo: several ongoing discussions with various division of Fujisawa city, or other cities, Chigasaki and Samukawa. Interviewing what kind of new types of report is needed, and what kind of function is needed for easy city management in WEB viewer.

Lokemon: continuous update of the application, with advertising the app via SNS

3.3.6 Lessons learnt

• Details of lessons learnt from the ongoing engagement, from feedback from stakeholders and from any initial trial activities

MinaRepo: there are several requests by stakeholders to add more functionality for easing city management. For example, viewer map should indicate operation region by each stakeholders, address should be able to be checked before sending report, it is better to set who should take care to each report. Those requests are written and managed in *Requirement text* by stakeholders (see Figure 8).

FIGURE 8: FUJISAWA: REQUIRED TEXT BY STAKEHOLDERS

Lokemon: recruitment has been an ongoing issue and it is difficult to reach many participants. We have about 300 users installed, but more installed user is needed to get significant and useful daily city information by citizen.

3.3.7 BigClouT technologies used

• Detail the BigClouT technology components that will be used by the trial

MinaRepo: BigClouT data dissemination/analysis technology. SOXFire for data dissemination. We would like to leverage ENG's business data analytics tool.

Lokemon: BigClouT data dissemination/analysis technology. SOXFire for data dissemination. We would like to leverage ENG's business data analytics tool.

3.3.8 Use case requirements analysis

• Explain which use case requirements the trial supports and indicate % coverage of the use case

80% coverage of the use case. More interaction with Fujisawa city traffic section is needed.

3.4 Fujisawa: Trial 2 Infrastructure Sensing

- Synopsis of trial

This trial focuses to experiment with BigClouT advantages for city infrastructure management. Especially, we perform a field trial of edge-computing with garbage trucks sensors for easy road condition management. The road is one of the important infrastructures of cities for their planning and development. For instance, people usually use them when they go somewhere, or plan land utilization to enrich their livelihood. However, roads need their repairing since most of those are built in the period of rapid economic growth at the same time and have begun to deteriorate. Thus, to inspect their condition sustainably for repairing roads, the city administration needs to employ persons for inspection under the current circumstances. Yet manual road inspection takes a lot of cost and time; for instance, in order to detect the damage or blur of the white line of a traffic sign, people have to check by looking and the range to check them by one person has limits. Simultaneously, a budget for roads has been reduced due to present social conditions. In short, the road inspection and repair is still not enough.

In this field trial, we combined BigClouT edge computing technique and data dissemination technique for road management. In this trial, we focus on city official vehicles, especially garbage trucks. Since garbage trucks run for their service every day and cover a whole area of the city, if the garbage truck equips a camera and takes pictures of roads, we can obtain road images for a whole area. Furthermore, we do not have to pay additional costs for labor or facilities. However, the number of running garbage trucks is so large (e.g., hundreds of trucks) that it is troublesome to save images data to storage and manage it. Simultaneously, if we upload images on each occasion that camera takes pictures, it would take numerous communication costs and oppress the bandwidth. In summary, our goal is proposing the system that can be attached to garbage trucks and detect the white line damage on the spot.

In order to achieve our goal, we implement a system of Deep on Edge (DoE), which integrates edge computing and deep neural networks. The overview of our system is depicted inbelow. DoE consists of edge computer (e.g., raspberry Pi3) with a camera and would be attached to garbage trucks. When DoE detects the line damage, the results would be reported and send to cloud computing via BigClouT data dissemination technique. Then, we use those reports and understand city condition. We treat the task of line damage detection as a classification problem. We then train a convolutional neural network (CNN), which is one of the deep neural networks using labelled images on GPU server. At inference time, DoE is loaded on edge computer and outputs a discrete probability distribution, assigning each taken image a likelihood that the white line in images is damaged. There are some constraints to using DoE on the edge computers due to their low specification, while we do not have to consider the number of parameters or their inference speed when we use DoE on the high-performance computer. So as to use DoE on the edge computers, we design CNN architecture as small as possible but to keep the accuracy high.

In summary, in the field trial, our purpose is to confirm that our DoE system can achieve easy road management by leveraging BigClouT technology and piggyback sensing model with city official vehicles.

In terms of timeline, we already started discussion with Fujisawa City. Until April, we will also start communication with other stakeholders who are assigned to garbage working. Until August, we will start first field trial with several garbage cars. Collected information will be soon shared with stakeholders, and expand our field trial with feedbacks from 1st prototype.

FIGURE 9: FUJISAWA: FIELD TRIAL FOR ROAD INFRASTRUCTURE MANAGEMENT WITH GARBAGE TRUCKS

3.4.1 Ethics plan

- Type of participants expected
  5 garbage trucks
- Type of data to be collected
  damage of road/road marks
- Ethical approvals
  NICT approval is needed and so their standard ethics approval process will be followed.
- Details on the procedures and criteria that will be used to identify/recruit research participants.
  Discussion with Fujisawa city
- Ethics summary

Ethics issue	importance (H/L)	risk (H/M/L)	status
Ethics plan documented	H	L	Yes, documented in each step and updated as needed
Informed Consent	L	L	NA - data gathered is infrastructure
Disclosure	L	L	Disclosure part of data (location of garbage truck) via public display ongiing
Data security	H	L	Only anonymised data held

3.4.2 Stakeholder engagement plan

- Specify the minimum number of participants required for the trial
  Single garbage truck
- Specify the target mix of participants (male/female, age, demographics)

NA
- Identify mechanisms for recruiting participants. Discuss the recruitment channels and partners

F2F discussions with Fujisawa garbage section
- Specify expectations for the participants. How many engagements, how often and for how long?

10 garbage trucks
- Identify the incentives for the users to participate

Reducing cost for road inspection

3.4.3 Data Management plan

- Describe the data that will be collected by the trial

Image, video, road condition data
- Describe the formats and how the data will be stored

Image files, movie files, cvs format data
- Will data be available into the BigClouT data repository/warehouse

Some of data can be available
- Will data be kept after the trial ends – provide details

Yes

3.4.4 Goals of trial and experimental methodology

- Goals of trial

Confirming that DoE provide easy and low-cost road management
- How will data gathered help you meet the goals

Comparing data collected by us and data which is collected regularly by cities.
- What is the evaluation methodology

Discussion with road management section in Fujisawa city
- What is the risk mitigation strategy

KPI or metric	Target	Status	WP1 linkage
Garbage trucks used	Min 10	0 (but basic sensors are already attached to 60 garbage trucks)	R1.2.59-60
Critical mass of data	300 readings per day	0	R1.2.62,64,65
Frequency of use	Every working day	Every working day	R1.2.63
Cost reduced for road management	1,000,000 yen per year	0	R1.2.66

3.4.5   Ongoing engagement

•   Details of ongoing engagement as initial work has begun
Ongoing discussions with Fujisawa IT section, Fujisawa resource coop organization.

3.4.6   Lessons learnt

•   Details of lessons learnt from the ongoing engagement, from feedback from stakeholders and from any initial trial activities
This trial is still under development so no specific lessons are available at this stage. The will be reported in the final trial evaluation.

3.4.7   BigClouT Technologies used

•   Detail the BigClouT technology components that will be used by the trial
BigClouT data collection and redistribution, BigClouT edge computing technique

3.4.8   Use case requirements analysis

•   Explain which use case requirements the trial supports and indicate % coverage of the use case
80% coverage of the use case. Original plan more focused to garbage reduce competition, but we currently more focus on infrastructure monitoring because we found that infrastructure management cost is high, based on discussion with Fujisawa city.

3.5   Grenoble trials

3.5.1   Common BigClouT Technologies used

The Grenoble city trials will make use of a core set of BigClouT components which will be used for both trials. These common components, shown in Figure 10, cover the main areas of the architecture including the:

- City service composition
- Data processing
- Historical and on demand data access
- Edge storage
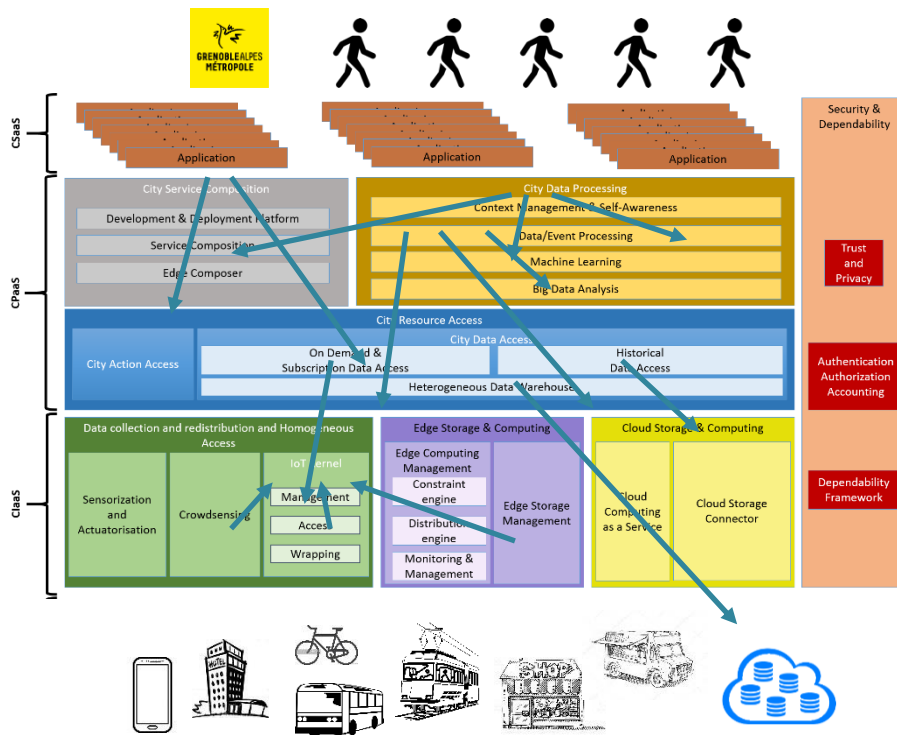- Cloud storage
- Data collection

FIGURE 10: GRENOBLE: COMMON COMPONENTS

For both of the Grenoble city trials a wide range of the components of the BigClouT platform will be used. Even if the first versions of the implemented prototypes will mainly use data coming from external data stores managed by Grenoble city's partners, it is scheduled to increase the number of features using live data coming from city's infrastructures, traders, partners, and users themselves. End users will interact with the **Applications** built by the developers using the **City Service Composition** functional block, and whose improvements will be guided by the analysis provided by the **City Data Processing** one. Data resulting from the processing of live or stored data will be stored at its turn in the **Cloud and Edge Storages** in manner of being accessible to the component in charge of the analysis.

The initial integration will be made using sensiNact as entry point for live data, and CityHub will be used to interact with external data stores. The newly created data will be stored in the CDMI Cloud Storage and the first business applications will be define using sensiNact Studio.

3.5.2   Data Management plan

•   Describe the formats and how the data will be stored

For both of the Grenoble city trials all data will be available in JSON format, lightweight data-interchange format easy to read/write and completely language independent. Also, the collected JSON data will be stored in the CDMI Cloud and Edge Storages of the BigClouT platform

•   Will data be available into the BigClouT data repository/warehouse

Data that will be collected by the BigClouT platform will be stored into its dedicated CDMI Cloud and Edge storages, in compliancy with privacy laws applying concerning users' data.

•   Will data be kept after the trial ends – provide details

Data will be kept in manner of creating statistic all along the time to evaluate the improvement of the user experience (use of services, conditions of use, etc), and to identify new potential feature to be provided and existing ones to be improved.

3.6 Grenoble Trial 1 Impact of events

- Synopsis of trial

Grenoble-Alpes Métropole hosts several large events, trade shows and fairs every year in its Alpexpo exhibition centre. In the future, it would like to host an increasing number of events in order to boost the attractiveness of the area and in turn to boost economic development.

Currently, there is no way for the Métropole to measure the economic impact of these events - for example - the use of hotels, shops, restaurants & transport – by the people attending these events. The Métropole would like to develop a tool that allows this monitoring to take place.

In turn, these results would be used to better attribute public resources to improve public services for the visitors (transportation, tourism, etc.) as well as bringing more visibility to the various stakeholders, helping to increase business.

The first use case is currently on standby as we advance on the 2nd use case (budget constraints).

Stakeholders:
- Business visitors / event participants
- Business visitor service providers
- Event organisers
- Congress centres
- Grenoble-Alpes Métropole
- Transport providers (public transport & taxis)
- Hotels
- Shopkeepers
- Restaurants

Describe the project, the key stakeholders, the goals, the benefits to stakeholders, the timeline and the BigClouT technologies used

3.6.1 Ethics plan

- Type of participants expected

The app is for business tourists- adult men & women - having agreed to the terms & conditions and downloaded the app

- Type of data to be collected

In return of provided services, we expect to be able to monitor some behaviour from the participant, such as the transportation mode used, restaurants and shops visited, amount of money spent during the stay, etc. in a complete anonymised or user controlled way. The user will be using a mobile applications, which will be in interaction with its surrounding environment composed of sensors, actuators and other devices.

The need to for anonymity is very important concerning information regarding individuals' movements and spending. It is therefore paramount to have a critical mass of participants in order for the results to be anonymised.

- Ethical approvals

Grenoble has been working with a legal advisor to verify that its trials are in line with French and European law, notably in terms of protection of personal data. This legal advisor verifies the use

case scenario and discusses potential issues with the partners before proposing recommendations.

The legal advisor also accompanies the partners in terms of detailing data collection, storage, protection, retention and destruction.

For the first use case, which is currently on standby, the process has been put in place for how to set up a data management plan but the use case has not been developed further than this.

- Details on the procedures and criteria that will be used to identify/recruit research participants.

The app will be available for download on app stores. Participants have to choose to download the app. The app will be publicised on events' websites, at the event, on the tourist office website and through other means (tbc).

- Ethics summary

Ethics issue	importance (H/L)	risk (H/M/L)	status
Ethics plan documented	H	L	Ongoing
Informed Consent	H	L	OK
Disclosure	L	L	OK
Data security	H	L	Only anonymised data held

3.6.2 Stakeholder engagement plan

- Specify the minimum number of participants required for the trial

100

- Specify the target mix of participants (male/female, age, demographics)

The targeted participants group is the one of business tourist without considerations on their gender, age or any other demographic characteristic. Of course, the fact of targeting this group limit the possible participants to a subset of the set of people between 18 and 65 years old, approximatively.

- Identify mechanisms for recruiting participants. Discuss the recruitment channels and partners

The app targets business tourists so the app will be advertised on information related to different events targeting international visitors (events' websites, badges, at the venues…)

- Specify expectations for the participants, how many engagements, how often and for how long?

Users will download the app and probably only use it for the duration of their stay - 2 or 3 days.

- Identify the incentives for the users to participate

It will provide them with useful information and recommendations as well as money-saving offers.

3.6.3   Data Management plan

•	Describe the data that will be collected by the trial
It is about collecting data relating to where and how people travel in the city and how and where they spend money while visiting Grenoble

3.6.4   Goals of trial and experimental methodology

•	Goals of trial
The goal is better identify the needs of business tourists in order to offer them better services when they are in Grenoble and also to provide feedback to policy makers concerning the impact of the events in order to provide arguments to invest in attracting more events to the city
•	How will data gathered help you meet the goals

The data collected will provide evidence of the impact of business tourists and how they currently use the city. For example, currently, we are unaware of whether business tourists use public transport or not. In the case that we see that most business tourists do use public transport, we will know that our current strategy is working. In the case that they are overwhelmingly using private transport or taxis, we will know that our strategy in marketing our public transport system is not working and therefore that we need to improve the strategy. Furthermore, the City Area is trying to attract more and more events to the area, based on the fact that these events bring money into the city but we have no evidence to prove this. The goal is therefore to provide this evidence in order to show why we want to attract more and more events and then to evaluate its evolution over time.

•	What is the evaluation methodology
As this use case is currently on standby, the KPIs to evaluate this use case have not been established with the partners
•	What is the risk mitigation strategy
Obviously, as this use case is currently on standby, we do not want to mobilise the stakeholders when we are not sure of being able to realise the final app. We are in continuous contact with the stakeholders due to the fact that we work together on other subjects and would be able to reactivate the development of this use case fairly quickly.

KPI or metric	Target	Status	WP1 linkage
Critical mass of downloads	25% of participants at first event	measures will start M24	R1.2.4
Critical mass of users	10% of participants in first event	measures will start M24	R1.2.4
Daily active users	10% of participants in first event	measures will start M24	R1.2.4
Average length of time spent using app	10 minutes	measures will start M24	R1.2.4

Frequency of use	During events (all day an evenings)	measures will start M24	R1.2.4
Satisfaction with app	average 4 stars	measures will start M24	R1.2.9
Permission granted to access personal info	75% of users	measures will start M24	R1.2.7
Feedback given	5% of users	measures will start M24	R1.2.9

Ongoing engagement
• Details of ongoing engagement as initial work has begun
The development of the Use Case 1 trial is currently on standby as the budget to develop an app is being concentrated on the second use case

3.6.5   Lessons learnt

• Details of lessons learnt from the ongoing engagement, from feedback from stakeholders and from any initial trial activities
The feedback from stakeholders has been overwhelmingly positive during meetings and through conducting a questionnaire with business tourists. Through these discussions, it was decided to provide an app that would assist business tourists during the event that they are attending and also for their free time in the city.
It was decided to put the development of the app on standby as the stakeholders involved in the Use Case 2 app were even more motivated and implicated in the development than the Use Case 1 stakeholders.

3.6.6   Use case requirements analysis

• Explain which use case requirements the trial supports and indicate % coverage of the use case

The trial as currently designed aims to cover the majority of the use case requirements for the Grenoble Use Case 1, ie R1.2.4-9. At this interim stage, approx. 85% of the use cases are covered. The intention is that as the trial planning continues, the coverage will be extended.

3.7   Grenoble: Trial 2 Industrial Zones

• Synopsis of trial
Grenoble-Alpes Métropole owns or manages several different industrial estates on its territory. These estates range in size and in the areas of activities, from high tech companies to artisans to shops and services.
The Métropole wants to be able to know who is using these estates and how. For example, how many people arrive each day by different modes of transport, how many people leave the sites for lunch, how many deliveries are received on the site, etc.
The goal is to be able to improve the services proposed by the Métropole in these zones, (for example, is there a need for improved public transport? Is there a need to put in place a canteen?)

and also to create a social network enabling for grouped orders and potentially car-sharing solutions.

The goal is to be able to better attribute public resources, to improve the working conditions on these zones and also to improve their environmental impact.

Three principal stakeholders have been identified and contacted regarding this use case:
- Inovallée Industrial Estate (See Figure 11)
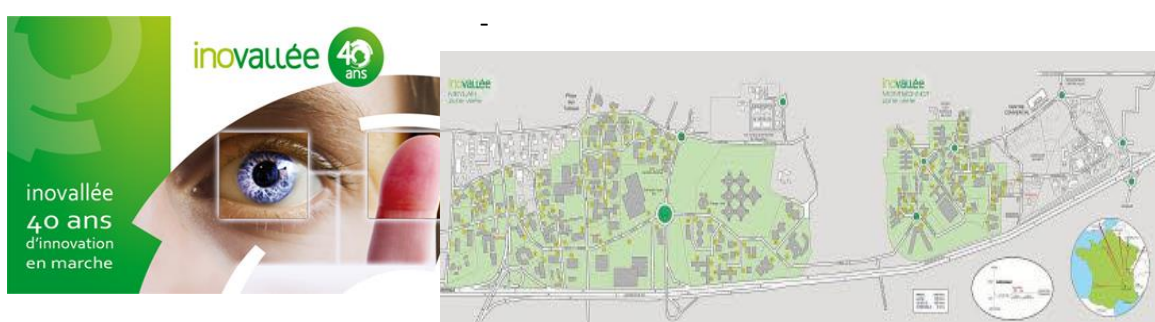- Espace Comboire Industrial Estate
- Presqu'Ile group of employeers

FIGURE 11: GRENOBLE: INNOVALLE BUSINESS PARK

Due to internal issues at the Métropole, the call for tender to recruit an app developer has been pushed back by approximately 4 months. The call for tender has been launched in January 2018 with a recruitment planned for February. We hope to have an app ready for launch by June.

3.7.1   Ethics plan

•   Type of participants expected
Men and women who work in the industrial estate
•   Type of data to be collected
For the first trial on the Inovallée industrial estate, in order for our app to function, we will need data relating to public transport (from the métro mobility app), menus from canteens, menus and locations of food trucks, a plan of the area, contact information for the different companies in the area, information relating to the different activities and events organised by Inovallée, locations of shops and restaurants and alerts relating to works (road works, maintenance…) being carried out in the area.
In return, we would like to collect data about how people use the zone - how do they get to work and what do they do while they are at work - do they use the services provided, what services are over-used/ under-used…
•   Ethical approvals
As with the first use case, the Métropole has paid particular attention to work very closely with the stakeholders as they have a much closer proximity to the final users and can help us better identify their needs and recruit users once the app is developed.
Grenoble has been working with a legal advisor to verify that its trials are in line with French and European law, notably in terms of protection of personal data. This legal advisor verifies the use

case scenario and discusses potential issues with the partners before proposing recommendations.

The legal advisor also accompanies the partners in terms of detailing data collection, storage, protection, retention and destruction. The legal advisor is currently working with the Métropole's legal department and with IT department in order to finalise these plans before the launch of the app.

• Details on the procedures and criteria that will be used to identify/recruit research participants.

For the launch of the Inovallée app we are working on recruiting adult men and women (18-65) working on the industrial estate by using several means such as: emailing from Inovallée to all companies on the zone, using social media, information on websites of all partners, public information boards, screens on public transport, glyers at the canteens/ restaurants, etc.

Ethics summary

Ethics issue	importance (H/L)	risk (H/M/L)	status
Ethics plan documented	H	L	OK
Informed Consent	H	L	OK
Disclosure	L	L	OK
Data security	H	L	OK, Only anonymised data held

3.7.2   Stakeholder engagement plan

• Specify the minimum number of participants required for the trial

To have a critical mass of users, we are aiming to have 300 users within the first year

• Specify the target mix of participants (male/female, age, demographics)

For the launch of the Inovallée app we are working on recruiting adult men and women (18-65) working on the industrial estate. There are 380 companies on the Inovallée estate, representing 12 000 jobs, 70% of which are in high tech industries. An initial survey revealed that approximately 83% of the employees surveyed are interested in an Inovallée app.

• Identify mechanisms for recruiting participants. Discuss the recruitment channels and partners

Many different approaches to ensure optimum uptake of the app are currently being discussed:

- Emailing from Inovallée to all companies on the zone to make them aware of the app
- Social media (Facebook, Twitter, LinkedIn) communication by Inovallée, the Métro and the Grésivaudan
- Information on websites of all partners
- Information on public information boards
- Information on screens on public transport
- Flyers at the canteens/ restaurants
- Article in Métro magazine (received by all 450 000 inhabitants at their home and distributed in public buildings)
- Possibility of organising a press conference with the different partners
- Launch event for users

• Specify expectations for the participants. How many engagements, how often and for how long?

We hope to have 500 downloads and 300 active users within the first year. We expect users to mainly use the app on a daily basis during their journey to work.

• Identify the incentives for the users to participate

Users will have up to date information which will help them plan their day. Eventually we could add on additional services such as reward points for partaking in environmentally behaviour (public transport, car-sharing…) which can be used to purchase goods & services in the zone but this is more feasible for the second trial in the Espace Comboire shopping area than for the Inovallée area.

3.7.3   Data Management plan

• Describe the data that will be collected by the trial

For the first trial on the Inovallée industrial estate, in order for our app to function, we will need data relating to public transport (from the métro mobility app), menus from canteens, menus and locations of food trucks, a plan of the area, contact information for the different companies in the area, information relating to the different activities and events organised by Inovallée, locations of shops and restaurants and alerts relating to works (road works, maintenance…) being carried out in the area.

In return, we would like to collect data about how people use the zone - how do they get to work and what do they do while they are at work - do they use the services provided, what services are over-used/ under-used…

Every effort has been made to ensure that the data collected will be managed efficiently. The project's legal advisor is working with the Métropole's legal department and IT department, alongside the CEA to define how data will be collected, stored, protected and destroyed. We have a plan in place to confirm consent for all data content discussed above.

3.7.4   Goals of trial and experimental methodology

• Goals of trial

The goal of the trial is to deploy a near-perfect app in the Inovallée industrial zone. It is important for the app to have as many features and as much information as possible from its initial deployment in order to ensure optimum uptake from users.

We are aiming for 500 downloads and 300 active users within the first year.

The overall goal of this trial is to provide a better service to users of the Inovallée industrial estate and in the long term to attract companies to set up their business in the area. Furthermore, we hope to reduce the environmental impact of the zone by encouraging and rewarding environmentally-friendly behaviour.

It is also planned to enlarge this app development and adapt it to other industrial estates in the city.

• How will data gathered help you meet the goals

The data that we get from the app will allow us to identify gaps in the services that we provide to employees in the zone and better divert public financing.

• What is the evaluation methodology

We have developed a certain number of KPIs to help us identify that the app is meeting its objectives:

KPI or metric	Target	Status	WP1 linkage
Critical mass of downloads	500 users in first 6 months, 750 in first year	Trial not yet started, target still OK	R1.2.16
Critical mass of users	300 in first year	OK	R1.2.16
Daily active users	150	OK	R1.2.16
Average length of time spent using app	10 minutes	OK	R1.2.16
Frequency of use	Every working day	OK	R1.2.16
Time of day app used	morning	OK	R1.2.16
Permission granted (to access other apps/ geolocalisation…)	75%	OK	R1.2.14, 15
Different pages visited	3	OK	R1.2.16
Shares/ publicity/ recommendations	50	OK	R1.2.14, 16, 17
Visits on page describing app on website	50	OK	R1.2.16
App searches on different app stores	50	OK	R1.2.16
No. of crashed sessions	50	OK	R1.2.16
Uninstallations	50	OK	R1.2.16, 18
Upgrades downloaded	50	OK	R1.2.16, 18
Satisfaction surveys filled in	5%	OK	R1.2.18
Satisfaction with app	average 4 stars	OK	R1.2.18

• What is the risk mitigation strategy

If we are unhappy with the results from the Inovallée app, we will try and improve it before testing it on another industrial estate (the second zone has a different profile as a shopping estate).

3.7.5 Ongoing engagement

• Details of ongoing engagement as initial work has begun

An app developer needs to be recruited at the beginning of the year in order to develop the app and deploy it. Currently within Grenoble-Alpes Métropole there are discussions concerning the content of the technical specs and the modalities for engaging a developer so this has been somewhat delayed.

3.7.6 Lessons learnt

• Details of lessons learnt from the ongoing engagement, from feedback from stakeholders and from any initial trial activities

The engagement from the stakeholders, particularly in the Inovallée area, have very much helped to shape this trial. From the point of view of Grenoble-Alpes Métropole, the principal angle of attack concerned the occupation of office space. With the involvement of Inovallée management team and the feedback from users of the zone, the trial has developed to becoming more user-centric, with a real service being proposed to the people working in the area.

3.7.7   *Use case requirements analysis*

The trial plan has been designed to cover the majority of the use case requirements specified in D1.2, i.e. R1.1.10-18. As currently planned it covers all requirements except R1.1.12.

3.8   Tsukuba: Trial 1 Tourist App
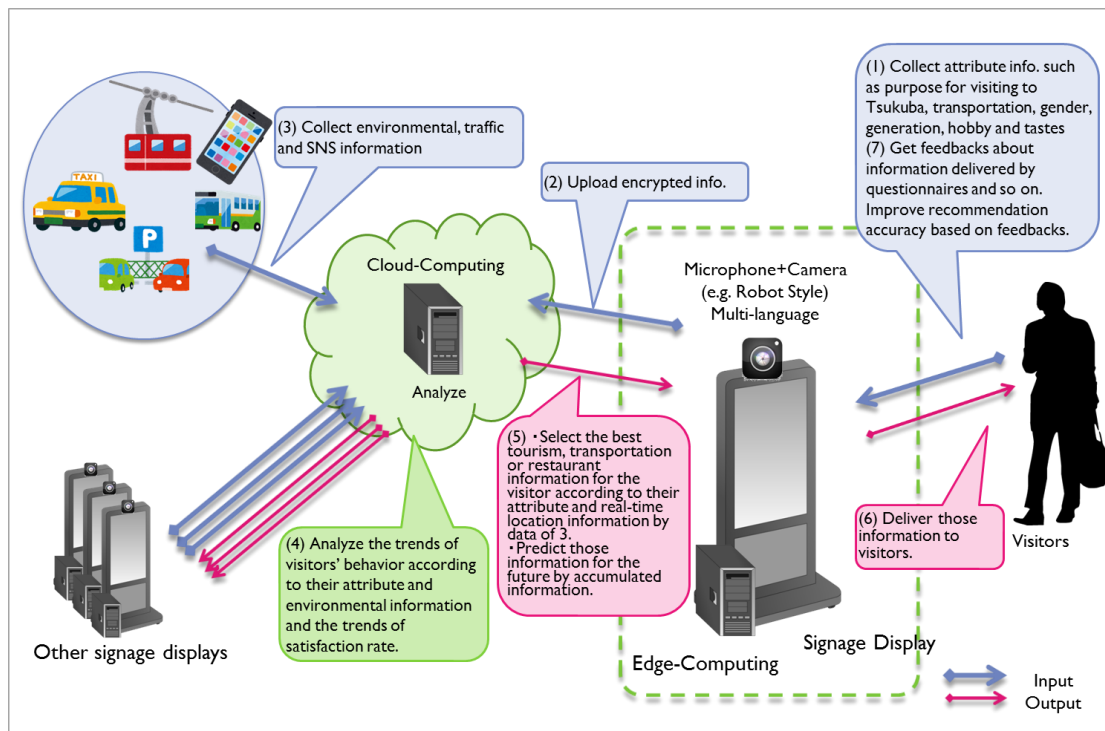
• Synopsis of trial

NOTE: This trial is still in a planning phase. We are considering integrating this trial plan into Trial 2 at Tsukuba City (Participatory Sensing App for Foreign Visitors) and to have a combined trial in the year of 2018.

Tsukuba is famous as a scientific city, where many research institutes are located, as well as a sightseeing place. For this reason, there are a lot of Japanese and foreign tourists to Tsukuba. Anecdotal evidence informs us that some visitors are not satisfied with their visit e.g., cannot climb the Tsukuba mountain due to bad weather, lack of information about popular scenic spots etc. One main reason is poor planning. Therefore, this trial aims to improve visitors' satisfaction by recognizing their behaviour and:

● Provide real time and optimal tourism information or tour route by recognising their behaviour and predicting environmental information (ie., real-time warning about routes with traffic congestions/shops with long queue/dangerous weather condition/… based on current location info).
● Recommending to tourists useful information, such as the popular scenic spots, and restaurant in the city so that they will stay longer or revisit Tsukuba again (ie., recommending scenic spots to foreigners based on profile info).

We have had discussions with city officials in Tsukuba City regarding this trial plan, and have their feedback regarding possible information sources and stakeholders, which are already integrated in the trial plan. An overview of the trial technology framework is shown in Figure 12. Data is collected from devices, passed through BigClouT cloud infrastructure and pushed to edge devices such as digital signage boards.

FIGURE 12: TSUKUBA: GENERAL TRIAL FRAMEWORK

3.8.1   Ethics plan

- Type of participants expected
    - Visitors including tourists, researchers, business person, etc.
- Type of data to be collected
    - Visitors' information: profile, location, smartphone's sensor readings, such as acceleration meter, luminometer, etc.
    - Social media data, such as Twitter.
    - Web data.

- Ethical approvals
    - Apply for assessments by research ethics committees in NICT and Center for Computational Sciences, University of Tsukuba. The process has not been started, because it is still in a planning phase. As mentioned earlier, we plan to integrate this trial plan into Trial 2 (Participatory Sensing App for Foreign Visitors) and will thus leverage the ethics process for that trial
- Details on the procedures and criteria that will be used to identify/recruit research participants.
    - In this trial, we plan to use a dedicated smartphone app, which will be able to be downloaded from App Stores. We plan to recruit participants by advertising the trial using different media, such as posters, brochures / flyers, social medias, such as Twitter and Facebook. Ethics summary

Ethics issue	importance (H/L)	risk (H/M/L)	status

Ethics plan documented	H	L	On hold until trial planning restarts
Informed Consent	H	L	On-hold
Disclosure	L	L	On-hold
Data security	H	L	Only anonymised data held. Data held max 1 year.

3.8.2 Stakeholder engagement plan

• Specify the minimum number of participants required for the trial

- 40 (This number is necessary to cover various visitors w.r.t. nationality, objective, etc.)

• Specify the target mix of participants (male/female, age, demographics)

- The target mix of participants will reflect visitors to Tsukuba City and will be determined in conjunction with city managers.

• Identify mechanisms for recruiting participants. Discuss the recruitment channels and partners

- We plan to put posters in different places in Tsukuba City, e.g., station, conference halls, University of Tsukuba, so that tourists can see them.

- We also plan to put brochures / flyers at tourist information desks, conference halls, etc.

- In addition, we use social media, e.g., Twitter, to advertise the trial leveraging BigClouT partners and local stakeholders to publicise the trial. We use a specific hash tag so that participants can track tweets related to the trial.

• Specify expectations for the participants, How many engagements, how often and for how long?

- We expect more than 100 participants (tourists) to join, and also expect them to use the smartphone app several times a day during their stay in Tsukuba (one day to one week).

• Identify the incentives for the users to participate

- We plan to provide the participants useful and timely information which is useful for their stay. We also plan to provide small gifts to reward outstanding contributions.

3.8.3 Data Management plan

• Describe the data that will be collected by the trial

- We collect from the participants their profile, location, and smartphone's sensor readings, such as acceleration meter, luminometer, etc.

- We also collect social media data, such as Twitter.

- In addition, we exploit Web data.

• Describe the formats and how the data will be stored

- Centre for Computational Sciences, University of Tsukuba, is in charge of managing data.

- The collected data will be sent to the data server, and stored using a relational database as relational data. Data must be encrypted when they are stored in portable medias, such as USB memory.

- Only BigClouT project members can access to the data.

- Data must be anonymized and/or aggregated so that no individual data will be released when they are included in documents, such as research papers, reports, etc.
• Will data be available into the BigClouT data repository/warehouse
- We can provide necessary data to BigClouT repository / warehouse depending on the terms and the privacy policy.
• Will data be kept after the trial ends – provide details
- The data will be kept for one year after the end of the BigClouT project, i.e., until May 31st 2020.

3.8.4 Goals of trial and experimental methodology

• Goals of trial
- The technical goal is to assess the usefulness and effectiveness of the BigClouT architecture in the context of real-time assistance of tourists using big data and predictive analysis technologies. The user focused goal is to improve the quality of the visit for participating visitors. A subsidiary goal is to better understand needs of visitors.
• How will data gathered help you meet the goals
- We exploit the collected data to estimate 1) the status of tourists, 2) extract useful information from social media data, and 3) extract useful information from Web data. The goal is to provide customized and timely information to tourists. To this end, real time contextual data is needed, and the collected data are used to extract such information.
• What is the evaluation methodology
- We consider integrating a feedback mechanism in the user interface of the application program whereby users can express the appropriateness of the provided information generated by the system. We can exploit them to evaluate the method.
- We will conduct user survey using questionnaires.
• What is the risk mitigation strategy
- There is a risk that we cannot recruit sufficient number of participants. To mitigate the situation, we are considering preparing gifts or motivate tourists to participate the trial.

KPI or metric	Target	Status	WP1 linkage
Target number of users	40	N/A	R1.2.32-39
Critical mass of users	100	N/A	
Daily active users	80	N/A	R1.2.46-49
Average length of time spent using app	10 minutes	N/A	
Frequency of use	Every working day	N/A	

3.8.5 Ongoing engagement

• Details of ongoing engagement as initial work has begun
- This trial is still in a planning stage. We have had several meetings with city officials in Tsukuba City, and recieved feedback regarding the trial plan, such as possible information sources, use cases, etc. We have reflected the feedback to the trial plan.

3.8.6 Lessons learnt

•   Details of lessons learnt from the ongoing engagement, from feedback from stakeholders and from any initial trial activities
>   - This trial is still in a planning stage.

3.8.7 BigClouT Technologies used

•   Detail the BigClouT technology components that will be used by the trial
>   - We plan to use an IoT gateway combined with SOXFire (Keio) and sensiNact (CEA), to collect data from smartphones as well as Twitter.
>   - We plan to apply predictive analysis techniques provided by the BigClouT partners for extracting contextual information regarding the participants, which is in turn used to provide useful information.
>   - We also use OLAP analysis to make analysis over the collected data.

3.8.8 Use case requirements analysis

•   Explain which use case requirements the trial supports and indicate % coverage of the use case
>   - This trial is based on the use case 2 in Tsukuba City and covers all requirements.

3.9   Tsukuba: Trial 2 Participatory Sensing App for Foreign Visitors

•   Synopsis of trial

Tsukuba city is one of the most famous scientific cities in Japan with more than 100 research institutes and universities. For this reason, many domestic/international academic meetings, including international conferences, are held in Tsukuba. Additionally, Mt. Tsukuba is a famous sightseeing spot which receives many visitors from Japan and overseas each year.

According to city officials in Tsukuba, they do not have comprehensive information regarding foreign visitors, such as the number, gender, country, popular visiting places, etc. and they do not always know the problems experienced by foreign visitors.

To cope with this problem, in this trial, we develop a participatory sensing system for foreign visitors using smartphones to collect problems experience by the users during their stay in Tsukuba. The application allows users to submit a problem along with a photo and descriptive texts. In addition, for submitted problems, the system allows volunteers to offer real-time responses in terms of texts, which are considered to be useful for the visitors to solve the problem. The objectives are as follows: 1) to collect problems experienced by foreign visitors in Tsukuba, 2) to make real-time assistance by volunteers to the visitors through the system, and 3) to collect basic information about foreign visitors in Tsukuba, such as profile, age, gender, living country, visited places in Tsukuba, etc.
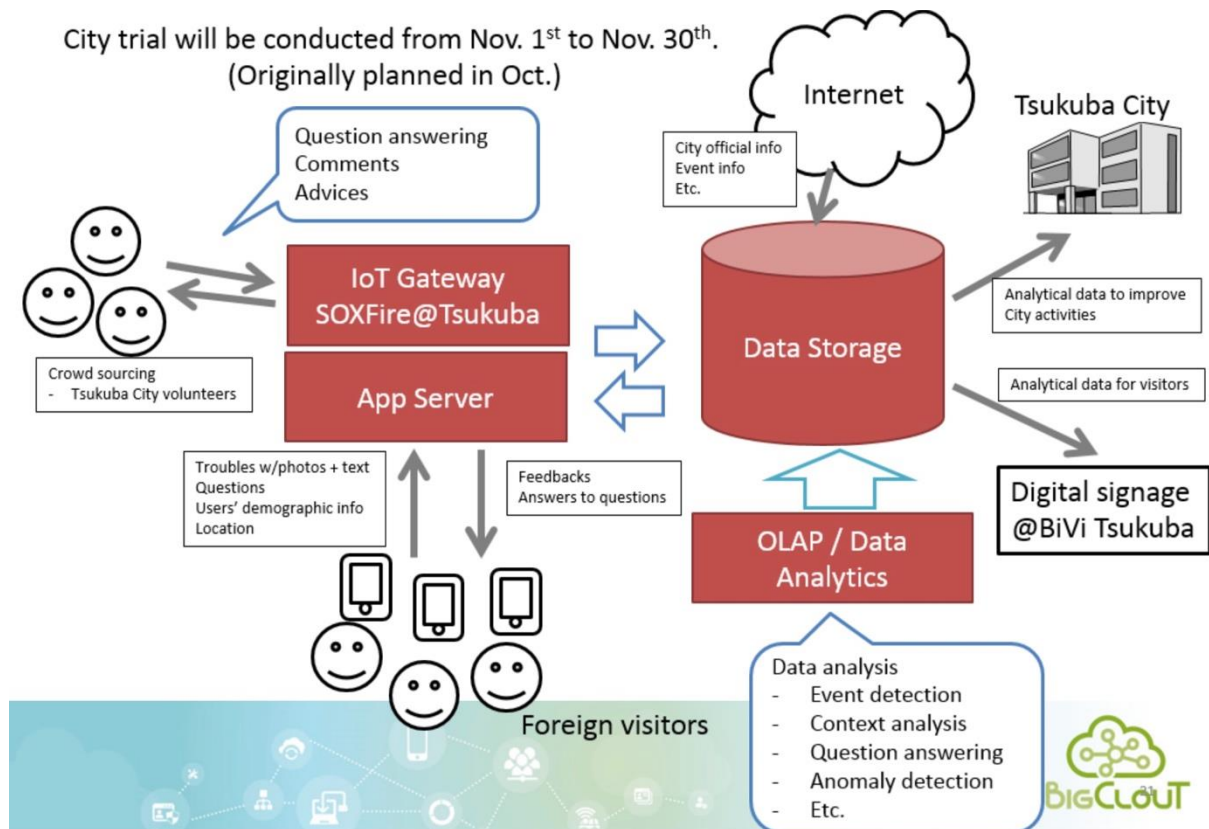
FIGURE 13: TSUKUBA: DATA FLOWS DURING TRIALS

The following shows some screenshots of the developed smartphone app.
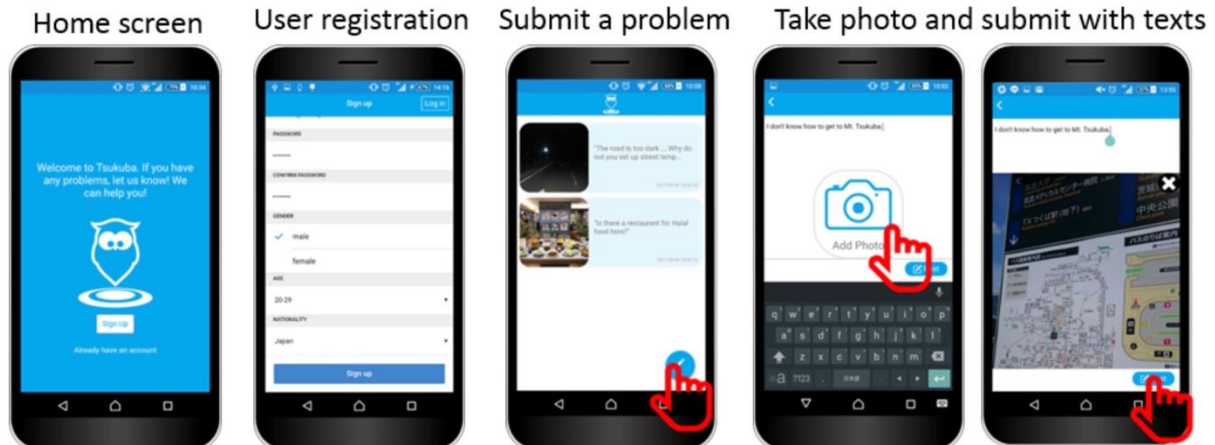

FIGURE 14: TSUKUBA: SMARTPHONE APP SCREENSHOTS FOR VISITOR APP

3.9.1   Ethics plan

- Type of participants expected
  - Foreign visitors coming to Tsukuba City.
  - Voluntary users who can answer to the problems submitted.
- Type of data to be collected
  - Visitors' profile: age, gender, living country, email, etc.
  - Visitors' submissions of problems: photo, location, and descriptive texts.

- Volunteers' submissions: texts.
• Ethical approvals
   - We have applied for assessments by research ethics committees in NICT and Center for Computational Sciences, University of Tsukuba, and both applications have been approved.
• Details on the procedures and criteria that will be used to identify/recruit research participants.
   - For foreign visitors, we put posters in various places in the city, such as station, conference halls, University of Tsukuba, etc. In addition, we put flyers in different places in the city. On the posters and flyers, we put QR code whereby users can install the smartphone app in their own devices. In total 50 posters and 8,000 flyers were distributed at the places below;
1) Tsukuba City Hall 2) TSU campus 3) Stations in Tsukuba (4 stations) 4) Mt. Tsukuba (4 places) 5) bus (3 routes) 6) Tsukuba International Congress Center 7) Souvenir shops 8) hotels (19 hotels) 9) Housing for Foreign Researchers (2 places) 10) Tsukuba international association. Lastly, we also sent messages to recruit participants via social media such as Facebook, Twitter etc.
   - For volunteers, we collected city officials with the help of Information Policy Division in Tsukuba City.

• Ethics summary

Ethics issue	importance (H/L)	risk (H/M/L)	status
Ethics plan documented	H	L	Done.
Informed Consent	H	L	When creating an account, all participants need to read and agree to the terms shown on screen.
Disclosure	L	L	Cloud data server is securely managed.
Data security	H	L	Only anonymised data held.

3.9.2   Stakeholder engagement plan

• Specify the minimum number of participants required for the trial
   - Foreign visitors: 40 (As a first trial, we start with a small number of participants. We expect five posts by each participant, which result in 200 posts in total. In the next year, we plan to increase the number to 100.)
   - Volunteers: 10
• Specify the target mix of participants (male/female, age, demographics)
   - We do not make any limitation except for minors and target a broad mix of male/female from all age groups with a focus on professional visitors 25-45 years old.
• Identify mechanisms for recruiting participants. Discuss the recruitment channels and partners
- We put posters in different places in Tsukuba City, e.g., station, conference halls, University of Tsukuba, so that foreign visitors can see them.
   - We also plan to put brochures / flyers at tourist information desks, conference halls, etc.

- In addition, we use social media (Facebook) to advertise the trial.

• Specify expectations for the participants. How many engagements, how often and for how long?
	- For foreign visitors, we expect them to make submissions of problems for five times in total during their stay in Tsukuba City (from one day to one week).
	- For volunteers, we expect them to make instant reply for any submissions made by the visitors, e.g., within 30 minutes
• Identify the incentives for the users to participate]
	- We give small gifts for foreign visitors who made five problem submissions and completed the questionnaire.

3.9.3   Data Management plan

• Describe the data that will be collected by the trial
	- We collect from the participants their profile, problem submissions in terms of location, photo, and descriptive texts.
	- We also collect from volunteers their responses in terms of texts to the problems submitted by the foreign visitors.
• Describe the formats and how the data will be stored
	- Center for Computational Sciences, University of Tsukuba, is in charge of managing the data.
	- The collected data are stored on the cloud server. When storing (a part of) data using a portable media, such as USB memory, they must be encrypted.
- The collected data will only be accessed by the member of the BigClouT project.
• Will data be available into the BigClouT data repository/warehouse
	- We can provide necessary data to BigClouT repository / warehouse according the terms and the privacy policy.
• Will data be kept after the trial ends – provide details
	- The data will be kept for one year after the end of the BigClouT project, i.e., until May 31st 2020.

3.9.4   Goals of trial and experimental methodology

• Goals of trial
	- The goals of this trial are as follows: 1) to collect problems experienced by foreign visitors in Tsukuba, 2) to make real-time assistance by volunteers to the visitors through the system, and 3) to collect basic information about foreign visitors in Tsukuba, such as profile, age, gender, living country, visited places in Tsukuba, etc.
• How will data gathered help you meet the goals
	- The collected data are processed and analysed to extract new findings, and provided to the city officials in Tsukuba City. This could be useful to improve the city operations for foreign visitors.
• What is the evaluation methodology
	- We conducted questionnaire surveys for both foreign visitors and volunteers.

- What is the risk mitigation strategy

- One of the largest risks is that we fail to recruit sufficient numbers of participants (foreign visitors). In that case we ask foreign people living in Tsukuba City to participate the trial. It is obvious that foreign residents have different perspectives than visitors. Nevertheless, they could contribute to report problems that have not been known before, and collecting such information is considered to be useful.

KPI or metric	Target	Status	WP1 linkage
Critical mass of downloads	50 users in first 1 month, 600 in first year	Collected 20 users in 2 months	R1.2.40,42-47
Critical mass of users	600 in first year	40 downloads in 2 months	
Daily active users	10	1	R1.2.47-50
Average Length of time spent using app	10 minutes	N/A	
Frequency of use	Every day	N/A	

3.9.5   Ongoing engagement

- Details of ongoing engagement as initial work has begun
  - - We have had a small trial with students in University of Tsukuba to collect initial feedback. We made use of the feedback to refine the user interface of the smartphone app.
  - - We have had several meetings with the city officials of Tsukuba City to discuss the trial plan (1 to 2 times each month for 7 months before the trial in addition to about 20 meetings with the stakeholders mentioning below). According to the result, we already put posters and flyers in Tsukuba City as described above.
  - - We had realized that stakeholder' support was necessary because it would be very hard to recruit participants from foreign visitors. Tsukuba University and Tsukuba city officers have therefore had more than 20 meetings with the stakeholders to ask for cooperation and to get feedback to the trial plan. The trial plan was refined based on this ongoing feedback process.

3.9.6   Lessons learnt

- Details of lessons learnt from the ongoing engagement, from feedback from stakeholders and from any initial trial activities

- We are evaluating our initial data from the small scale trial (Nov-Dec). One clear lesson is related to recruitment which was lower than hoped. One major reason is the language barrier; i.e., we assumed English as the basic language in the app and advertisement, whereas it turned out that most of the foreign visitors in Tsukuba City are Chinese. To recruit more participants, we need to support different languages so that people from different countries can participate readily. - Thanks to the supports from the stakeholders, we have very valuable feedback from them after the trial which is outlined below. We are analyzing this feedback and developing lessons for the next trial.

- Kanto Railway Co., Ltd.
  - Many foreigners (mainly Asians) were visiting Mt. Tsukuba and they took the flyer.
  - It is useful to know that some people posted the problems about a bus. We would like to cooperate on next field trial.
  - Problems about a bus were not many. One of the reasons may be our staffs stood to guide visitors at the bus terminal in November since many people visit Tsukuba in November.

- Tsukuba Tourism and Convention Association
  - Condition for present exchange, which is to post 5 problems and answer the questionnaire, was too severe.
  - The application should be available not only in English but also in Chinese or other Asian languages since 50% of foreign visitors to Tsukuba is from China.
  - The application should be available for iOS because there are many iPhone users.

- Tsukuba international association
  - Many foreigners who live in Tsukuba city use iPhone. So support for iPhone is necessary

- Tsukuba Scenic Railway Co., Ltd.
  - Have distributed all flyers.
  - Most foreigners visiting Mt. Tsukuba was Asian people.

- Tsukuba International Congress Center & Tsukuba Science Tour Office
  - Condition for present exchange was too severe. It would be better if users can get present at hotel they are staying.
  - The number of the problems posted seems reasonable since only a few international congress / science tour for foreigners were held in November. Problems posted seem to be useful.
  - It would be better if the target of HukuRepo is expanded to foreign residents in Tsukuba (not only visitors).
  - The application should be available in Asian languages.
  - Should co-operate with research institution in Tsukuba because they hold international meetings.
  - The application should be available for iOS because there are many iPhone users.

- Tsukuba City Bussankai
  - It seems many foreigners who live in Tsukuba City or who visit the international congress centre understand Japanese. And visitors from overseas are mainly Asian people who don't speak English. These may be the reason why the number of the users of HukuRepo, which was only available in English, was not many.

3.9.7   BigClouT technologies used

- Detail the BigClouT technology components that will be used by the trial
  - One key technology component that we are interested in exploiting is the data analysis method (OLAP) to make analysis over the collected data.

3.9.8 *Use case requirements analysis*

•   Explain which use case requirements the trial supports and indicate % coverage of the use case

    - This trial is basically based on the use case 2 in Tsukuba City.
    - This trial covers all requirements in the use case 2 except for the use of data analytics / predictive analysis.

4   CONCLUSION

This document is designed to provide a framework and guidelines for developing the BigClouT field trials. Obviously, the circumstances and context for each field trial differs and so the guidelines are not prescriptive. Rather they should be taken as a start point for trial planning and adapted as needed.

Where possible, this deliverable provides links and resources to useful templates or background information on the core areas - a particularly rich resource, and one that should be used when possible, is the EU's responsible Research and Innovation (RRI) imitative - https://www.rri-tools.eu.

The onus is on trial partners to develop and use the plan documents described in this deliverable - each document, whether it is ethics, engagement, evaluation, data management or research goals, should be treated as a living document and should evolve as the trials progress. While completeness is a worthy goal, a useful and useable, albeit imperfect document, that guides trials through all their stages is critical to success.

5 ANNEX

Note – appendices removed for brevity. They can be found in deliverable D4.1

Appendix 1 - BigClouT Ethics Primer
Appendix 2 - Procedures for real-world trials
Appendix 3 - Guide to obtaining informed consent
Appendix 4 - Guide to secure data storage