Contents

1. OBJECTIVES

The proposed action CITI-SENSE-MOB will develop, test and demonstrate mobile services that exhibit the potential for mobile technologies in the environmental health and climate change domain, using the concept of a Citizens' Observatory (where data is provided both automatically and manually, through users). The observatory will be part of an environmental health monitoring system and environmental health knowledge base created from GMES information, GNSS signals and the citizen observatory data collection concept developed in the FP7 project CITI-SENSE (Development of sensor-based Citizens' Observatory Community for improving quality of life in cities). The service innovation is builds on the GEOSS based Sensor and service platform developed in the FP7 project, CITI-SENSE, but further enhanced for the support of mobile sensors and mobile users. The case study will be performed in the Oslo Metropolitan area. This region is experiencing rapid demographic growth. In some sub-areas, this growth is as high as 2-3% per year. This creates pressure on all infrastructures, including traffic and health management as well as on the maintenance of environmental quality.

CITI-SENSE-MOB will mainly address the EMMIA strand II: 2: **Large-scale demonstrators in support of GMES and GNSS based services**. The main objective of CITI-SENSE-MOB is to develop new mobile services to support green growth in the Oslo area by providing citizens and authorities' information related to transport and environmental quality (e.g. air pollution and climate gas emissions). This will be achieved by developing and demonstrating a range of innovative mobile services based on GMES and GNSS systems services from the GEOSS based architecture and platform developed in the CITI-SENSE project. The downstream applications developed will contribute directly to resolving the HORIZON 2020 challenges related to health, well being and climate change as well as alleviate certain infrastructure pressures experienced within the Oslo regions, for example, by tracking user mobility.

To achieve its main objective, CITI-SENSE-MOB will develop key end user mobile device applications, which will not only enable the user to receive environmental information directly to their phone, but will also utilize that mobile device as a sensor node in the network collecting environmentally relevant information. Examples of services that integrate collected data with other data available through the Citizens' Observatory Toolbox are related to eco-driving, Personalised Environmental Information and Environmental Health Alerts and Recommendations.

Further, tracking the public's travel habits would enable us to develop a mobility map. This can be used to provide the public with key information (e.g. routes with less traffic, travel times, etc), but also with related information such as how to reduce emissions and improve your economy (by eco-driving) or what you should do in a long tunnel to reduce harmful exposure to pollutants (Health Alerts). CITI-SENSE-MOB provides services to citizens and authorities, and to complement this we will develop large scale mobile service enablers necessary for the fuller development of such services, and for creating related exploitation or business opportunities.

2 JUSTIFICATION

2. 1 Identification of perceived needs and constraints in the target groups

The target groups in CITI-SENSE-MOB include transport-related agencies in the Metropolitan Oslo area, such as Ruter (public transport, www.ruter.no), the general public, Health interest groups (NAAF, www.naaf.no) as well as local governments. The needs and objectives for each of these groups differ, but require an underlying framework that contains overlaps between the various services that support them.

Public - The major reason that impedes the general public from utilizing current air quality related services is the lack of understanding what the data is telling them. For instance, if a user is informed that the AQI in Oslo (Air Quality Index) is poor, what does that mean for him? Sensitivity to airborne pollutants is very different from one person to another and in many cases highly dependent on the individual's patterns of behaviour. Yet, while each individual has a unique relationship to the environment, the information on the state of atmosphere and related hazards available today is entirely generic, and by no means personalised. CITI-SENSE-MOB will address this by providing the user with tools that will not only enable him to track the current Air Quality in his *actual* location but also provide him with the means to understand how this data relates to him personally.

Local Government - For local governments the need for improved services is quite different than it is for the general public. By mounting sensors on mobile platforms CITI-SENSE-MOB will provide information at spatial-temporal scales related to citizen activity by performing real-time monitoring at the street level. Urban-scale air quality mapping will provide an input to local authorities enabling the management and control of air pollution in the cities to a much finer degree than is currently possible. The data from the project will enhance existing air quality monitoring networks by extending them with a significant increase in spatial data density. Currently the coverage from static networks is insufficient and this new data will enable municipalities to define abatement strategies to reduce air pollution peaks under special circumstances (fast decisions based on current measurements) as well as the long-term planning for emission reductions. The project will further have substantial policy impacts, especially with respect to supporting the European Air Quality legislation application and enforcement. Low-cost sensors may support compliance checking and contribute to an improved development and implementation of environmental policies and strategies with respect to ambient air quality.

Transport related agencies - Transport is responsible for a large part of the overall greenhouse gas emissions in developed countries, and it is one of the sectors where carbon dioxide emissions continue to increase. Moreover, transport also has an impact on air quality, noise, health and quality of life. Transport remains a major source of air pollution causing major harm to both human health and the environment. The CITI-SENSE-MOB project will provide an integrated approach by measuring two target gases, CO_2 (greenhouse gas) and NO_x (traffic-related air pollutants, under certain conditions related to PM, 'particulate matter') as well as PM_{10} and $PM_{2.5}$. This integrated method is central to developing a sustainable transport system that takes into account both climate change and air quality emissions. The data gathered in the project will allow transport agencies to develop their green agendas and design better planning to delivery low emissions transport projects that can be licensed by local authorities.

Health Interest Groups – Representing public health, groups like the Norwegian Asthma & Allergy Society (NAAF) provide key services to a substantial number of at risk citizens. These people suffer greatly at certain times of the year due to ambient air quality issues, and consequently have a critical demand for services that could enable them to take actions to

mitigate their situation. However, at this time, these services are basic, limited to web based offerings only and do not provide any dynamic capability (alerts, for example.)

2.2 List of target groups with an estimate of the anticipated number of direct and indirect beneficiaries

Key beneficiaries of mobile based services are municipalities, Human Health Interest groups, individuals with health related issues (asthma/allergies/stress) and individuals interested in the environment.

In 2001, Commissioner Palacio claimed that downstream services resulting from the satellite had a potential market of Euro 9 billion a year. In addition, in the same period, Galileo would lead to Euro 200 billion in indirect savings for each one percent reduction in travel time in road transport alone. CITI-SENSE-MOB will develop pilots that will clearly demonstrate the possibilities of utilizing GNSS based services that will support a wide range of requirements from end users and stakeholders that will meet critical requirements within the Oslo region.

Traffic - The transport-related agencies in the Oslo area (pop. 1,5 mill) need more advanced and integrated tools for environmental management, and information dissemination to public and government. The number of users of public transport systems in Oslo numbers in the millions annually. All users of these systems will benefit from any mitigation processes undertaken as a result of the CITI-SENSE-MOB project.

Public -The public, in particular, will receive greatly enhanced traffic-related AQ information and understanding of AQ status as it pertains directly to them. They are currently constrained by lack of knowledge in interpreting AQ data and also in the necessary procedures to acquire such information.

Local Government -Benefits to local governments as a result of the CITI-SENSE-MOB initiative are increased decision support mechanisms, better air quality management processes and improved accuracy for reporting and compliance of Air Quality regulations.

Health Interest Groups – Provide tools to enable at risk citizens to take mitigation actions that can demonstrably improve their quality of life.

2.3 Reasons for the selection of the target groups and activities

Traffic groups have been selected because they are directly affected by harmful gases and particles emitted especially close to the roads and in this case, by vehicles themselves. The public is a target group because there are many citizens who have breathing problems, allergies, or other related issues. In addition, there are citizens who are more health-conscious than others and who would like to know more about their environment in order to make lifestyle decisions which can have beneficial impacts. The local governments need to comply with EU air quality regulations which have been passed down to them by the Norwegian government. The government is also concerned with the health of its citizens and lowering health related costs by keeping its citizens healthy is a priority objective. Research groups directly related (and those not currently involved) to the project can use the lessons learned and also contribute on the shape of the infrastructure being developed, take advantage of the datasets generated and develop further synergies with the project in the future by adopting similar strategies. This could lead to a further scaling of the project on a wider basis within Europe.

2.4 Relevance of the project to the target groups

The traffic group can include both public and governmental departments which have a clear need to monitor the ambient Air Quality at, or close, to the main roads. The public would

include those commuters who are spending a lot of time in traffic and being exposed to low levels of air pollution on a regular basis. The governmental departments need to monitor the AQ levels on the roads to determine the exposure of citizens (including its own workers or members) who are being exposed to harmful gases and particles on a regular basis.

The public is a relevant group as it is directly affected by high levels of air pollution, especially those who have a health related issue that can be impacted by the Air Quality. By providing information to users that is both easy to understand and highly relevant for them, people can will be able to make the choice to change their lifestyle or habits in order to promote long term health benefits.

2.5 Relevance of the project to the objectives of the call

The CITI-SENSE-MOB will mainly address the Strand II: "Large-scale demonstrators in support of GMES and GNSS based services", and is highly relevant to the objective of the Strand II "implementing on a large scale, innovative services based on GMES and GNSS to address specific societal challenges or to facilitate the emergence of new industries in a given region or metropolitan area". Through the Citizen Observatory Toolbox service development in the action, it will also contribute to the first strand: "Strand 1: GMES and GNSS based services voucher schemes".

Table 1: Overview of existing relevant data services in Norway

Name	Short description	Target group	Who collects/owns it
Pollen index	For a list of locations forecast of different pollen (Grass, Salix, Or, Mugwort, Birch, Hazel) conditions.	Asthma and allergy patients	NAAF Public Portal: www.pollenvarslingen.no/temasider/meldingstjenester/logg_inn.aspx Web service: xml.pollenvarslingen.no/pollenvarsel.asmx
Air quality index	Web service with current AQI for all stations and cities in Norway	Service providers	NILU Public Portal: www.luftkvalitet.info Web service: dataservice.luftkvalitet.info/airqualityindex/area/v2/?area=oslo,&format=xml&hoursback=-24&key=6LNHnePf
Air Quality Measurement data	Air quality data (CO, NO2, PM10, PM2.5, etc)	Service providers/authorities/Public	KLIF, NILU Public Portal: www.luftkvalitet.info Web service: dataservice.luftkvalitet.info
UV index	The strength of the UV radiation from the sun at a particular place on a particular day. There are five levels (low, moderate, high, very high, extremely high)	Service providers/authorities/Public	NILU Public Portal: http://www.uv.nilu.no/index.cfm Not a web service, but can be converted
Transport information	Public transportation route, travel time	Public, especially drivers	Ruter Public Portal: http://www.ruter.no
Weather conditions and forecast	Information on temperature, rainfall, wind speed and direction	Service providers/authorities/Public	MET Public Portal: http://www.met.no

3. DETAILED DESCRIPTION OF ACTIVITIES

The activities will be organized into five Work Packages (Figure 1).

- WP 1: Design of services
- WP 2: Adaptation of CO_2 and NO_x sensors/sensor network to mobile environments
- WP 3: Service acceptance trials
- WP 4: Product implementation
- WP 5: Management and dissemination and exploitation of project information

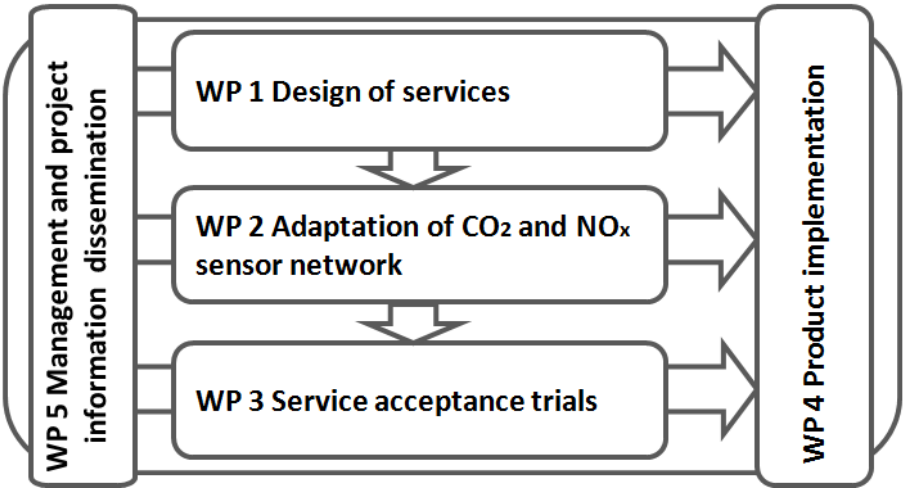

Figure 1 Overview of CITI-SENSE-MOB structure

3.1 WP 1 Design of services (NILU)

The CITI-SENSE-MOB will develop a mobile service application system fostering its integration with other, already existing applications (e.g. weather forecast) and with heterogeneous data sources (institutional and user-based information) (Table 1). This service will be a product of Work Package 4, but it will be developed from the work done in Work Package 1. The design and specifications for the main products will be the main focus of this Work Package.

The services will be designed to meet the needs of citizens in the Oslo region by providing both transport and environmental services, and of local stakeholders in order to better promote and grow their businesses which can be based on the new services provided by the project. An important impact of the project will be to support local green initiatives and developments, for example, by fostering eco-driving related activities and services.

CITI-SENSE-MOB will develop a comprehensive Citizen Observatory Toolbox (COT) which comprises of a series of applications/services which support and complement each other. These include one major component which informing the public on current environmental conditions, obtaining VGI input from them.

T1.1 Interactions with Target Groups (KI, NILU, UNIK, MOVATION) Feedback from stakeholders and users based on available services, data streams. Input provides basis for specifications to feed into WP4.

T1.2 Conceptual Service Design: (NILU, KI, UNIK, MOVATION, SINTEF) Capture all requirements, specifications, architecture and create conceptual design document. Input from WP4 supports this task. This will include the concept for COT, a set of tools provided in a

mobile device. This can be a suite of services, or a single application. It will provide personalised data direct to users according to their interests, where users can create exposure/threshold limits for any components (meteorology, air quality, etc) and receive alerts. Users can also input their own data on various environmental and health related issues. User observations including physiological responses (such as have headache, am dizzy, sneezing, etc.) and ambient conditions (is raining, is snowing, is windy, etc) will be included in the database.

Deliverables:
D1.1 Conceptual Service Design Document **(M6)**

3.2 WP 2: Adaptation of CO_2 and NO_x sensors/sensor network to mobile environments: (NILU)

WP2 will focus on the implementation of micro-sensors for measuring CO_2, NO_2/NO_x and PM on mobile platforms (cars and buses). This brings new challenges as we need to go from fixed, isolated and well controlled systems to an open and scalable infrastructure where many micro-sensors generate terabytes of data regarding the time, their position and pollutant levels, while localization in cities is a challenging task due to the often low number of directly visible satellites.

The WP will implement atmospheric quality monitoring based on low-cost sensor technologies to complement existing monitoring capabilities, in order to provide products and services to citizens and authorities. Central to this is the use of smart phones with specialized applications obtaining, managing and providing information about environmental conditions.

The WP will acquire start of the art quality assurance sensors for CO_2 and NO_2/NO_x. The sensors will be integrated on a measurement platform that will be allocated on the vehicle. The measurement platform will be designed not be invasive to the vehicle and will obtain the power from the vehicle. The platform will also integrate a data-logger for data acquisition, a GPS receiver that supplies precise geospatial information and a system for data transference and mobile communications based on for instance GPRS. The platform can eventually incorporate Bluetooth technology for exchanging data over short distances.

The work will be conducted in gradual steps and with evaluation in every stage. In the phase 1 of the project, the prototype platform will be installed in a convenience sample (2-4 kits). The performance of the measurement platform will be evaluated continuously. Central to this evaluation will be to identify the main issues related to calibration of the sensors and communication of data. On phase 1 we will investigate different methodologies and schemes to periodically calibrate the sensors. One of the option we will investigate is the on-the-fly calibration, that consists on calibrate the sensors when they pass one of the fixed monitoring stations that are periodically calibrated.

On phase 2 the measurement platform will be installed on buses. Previous to the installation we will make a selection of a sub network of the buses and routes. The goal of this is to optimize the spatial and temporal coverage of the area. Moreover, the optimal design of the network will contribute to enlarge the systems tolerance to failures as for instance to sensor malfunctioning without a detrimental lose of coverage.

T2.1 Acquisition of sensors/design of mobile sensor measurement platform: (NILU)
Commercial air pollution sensors for CO_2, NO_2/NO_x and PM will be acquired. The sensors will be integrated with a data logger, a GPS and a communication system. The system will be adapted for its use in a vehicle. We will determine if the integration of all the sensors on the platform function as planned. The sensors may function well individually, however the functionality of the platform as a whole needs to be verified.

T2.2 Implementation of the measurement platform in convenience sample: (NILU) The optimal and safer way to allocate the measurement platform on buses will be investigated. The platform's mechanical characteristics need to be determined in order to ensure a safe ride on the bus and to comply with safety regulations. The measurement platform will then be installed on 2 to 4 buses to test the performance (software and hardware).

T2.3 Investigation of calibration techniques for mobile platform: (NILU) Sensors need to be calibrated every certain time. Manual calibration can be very time consuming, and requires the vehicle to be stopped. New, on-the-fly, calibration techniques will be considered and investigated.

T2.4 Performance Evaluation of the System: (NILU) The data and methodology from phase 1 will be evaluated to ensure that best practices are conducted on phase 2.

T2.5 Bus route selection, platform installation, spatial/temporal coverage optimization: (NILU) The routes and times for the buses in the Romerike area will be revised to ensure an optimal coverage of time and space.

T2.6 Implementation of the measurement platform on buses: (NILU) The measurement kit will be installed in those buses selected in the previous task. The data from the buses will be revised in a continuous basis. This task will also involve the maintenance of the kit (calibration, replacement in case of failure, etc.)

Deliverables:

D2.1 – Evaluation of the performance of the phase 1 **(M6)**

D2.2 – Report and plan for phase 2 **(M12)**

D2.3 – Evaluation of the performance of the phase 2 **(M24)**

3.3 WP 3: Service acceptance trials: (NILU) Vehicles of pilot distributor, resolving implementation conflict between public and private sectors.

Ruter A/S has been chosen for this project as the provider on whose vehicles we will install and mount the micro-sensor platforms. Ruter A/S is the Oslo metro area provider of public transportation. They market, sell, organize and arrange for the Oslo and Akershus kommunes (counties.)

Ruter A/S has agreed to the use of their buses at any of their scheduled lines. The service acceptance trials will be performed in six steps:

Figure 2 Process showing service acceptance trials steps

T3.1 Communication testing: (NILU, SINTEF, UNIK) Testing the communication between platform, GNSS and mobile network. The platform needs to be able to accept incoming GNSS signals and be able to relay both position and sensor information to the server over the mobile network.

T3.2 Server trial: (SINTEF, NILU, UNIK) Verification of the server handling the information collection, storage and communication further down the information chain.

T3.3 Road trials I: (NILU, UNIK) Initial testing on a single bus, determining glitches and unexpected issues. This is a "live" test where the platform is tested on a vehicle that it is

intended for. It is important to see the platform function properly in all aspects before more widespread use.

T3.4 Road trials II: (NILU, UNIK) Testing of the platform on several of buses on a single route. This portion of the test is to verify that the whole system functions with many platforms feeding information to the same server.

Deliverables
D3.1 Report 1 – Testing **(M3)**
D3.2 Report 2 – Road Trials Preliminary **(M4)**
D3.3 Report 3 – Road Trials Final **(M6)**

3.4 WP 4 Product implementation (SINTEF)

This Work Package focuses on providing the architecture and platform for real time management of mobile sensors, the social media platform and the environmental products and related mobile application development.

- Provisioning of the system architecture based on GMES, GNSS and GEOSS
- Provide a Mobile sensor platform
- Provide Social Networking platform
- Provide Environmental products with supported Mobile apps
- Provide Mobile socialtainment apps

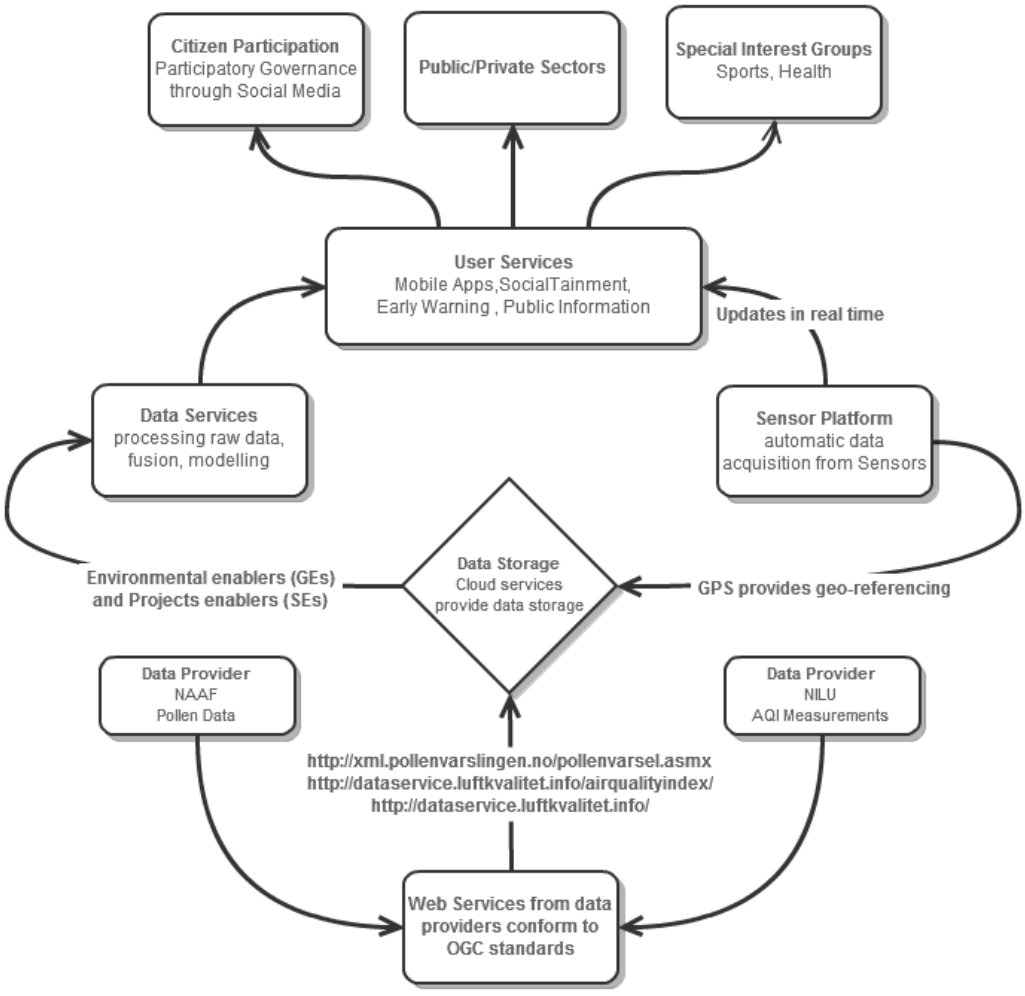

Figure 3 Products linkage overview

Task 4.1 CITI-SENSE-MOB Architecture (SINTEF, UNIK, MOVATION)

The CITI-SENSE-MOB Architecture will be based on the GEOSS architecture supporting GMEA and GNSS, with a foundation on the GEOSS-based CITI-SENSE (ENV-FP7) architecture. This needs to be carefully defined in order to ensure both alignment with GEOSS but also to futureproof the application products and to ensure interoperability with other systems.

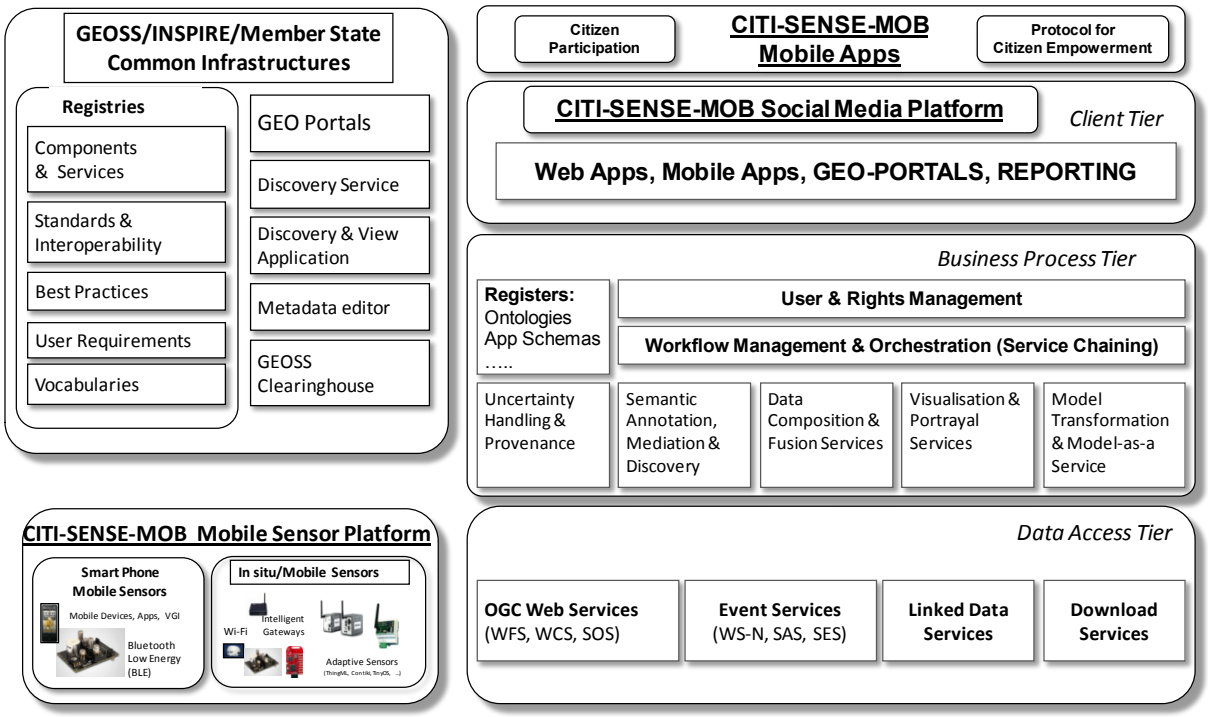

Figure 4 GEOSS based architecture of CITI-SENSE-MOB

Task 4.2 Mobile Sensors Management: (SINTEF, NILU, UNIK) The support for management of mobile sensor data will be provided by an adaptation of the SensApp platform from SINTEF for mobile sensors. The SensApp is developed in particular for the support of data streaming and real time handling of data from sensors and will provide the platform for building our products upon.

T4.3 Community Building with Social Media Platform: (NILU, UNIK, MOVATION) Develop tools to foster communication between the project, stakeholders and users. This will include project dissemination portal, internal project management site and Social Media Platform.

T.4.4 Modelling and Visualisation: (NILU, SINTEF) Based on the available sensor information a set of environmental model products will be developed, e.g. combining data from sensors with existing measurement infrastructures to create a comprehensive overview of pollution on the target routes by feeding the data into a Model and producing a dataset that can be visualised. These results will then be utilised by the mobile apps and services.

This task will be to create a method for showing the positioning of mobile sensors as they travel around the city in real-time. Displaying of measurement data from the sensors in real-time in an online GIS application, and displaying of citizen observatory generated data from users.

T4.5 Mobile products Phase I: (SINTEF, NILU, UNIK) We will use the results from the interaction with users and insights from WP1, related to the desires and needs of potential users, and stakeholders (NAAF) both on content and format (for instance SMS alerts or just mobile application). This task will be split into two parts, with the main focus of the first part being the development of the dissemination app, and the second part being the development of the VGI (Volunteered Geographical Information) platform.

T4.6 Mobile products Phase II: (SINTEF, NILU, MOVATION, UNIK) A key product aimed at the Citizen's observatory is a mobile phone application which will enable users to input their own observations relating to current environmental conditions and their own perceived health. VGI functionality will be implemented in the second phase of development for the phone app.

Deliverables

D4.1 Launch Project Portal **(M3)**

D4.2 Provisioning of Social Media Platform **(M9)**

D4.3 Architecture Report **(M9)**

D4.4 Mobile Sensapp Platform **(M9)**

D4.5 Visualisation System online (GIS) **(M13)**

D4.6 First Phase mobile phone products/apps **(M9)**

D4.7 Second Phase mobile phone products/apps (VGI) **(M24)**

3.5 WP5 Project Management, Dissemination and Exploitation (KI)

The main objective of the CITI-SENSE-MOB management and dissemination is to ensure that project outcomes are delivered in time, within budget and to the highest possible standards, to raise public awareness, spread the project results and to promote their commercial exploitation.

Tasks

T5.1 Administrative co-ordination and reporting: (KI) Provide contact to the contracting authority, and assist partners in preparation of timely reports. It will also oversee the day-to-day operation.

T5.2 Project management: (NILU) Provide day-to-day management of project activities, ensuring that links between partners and the necessary communication take place, and that potential problems are being identified and solved. Will identify operational risks and manage them.

T5.3 Development of dissemination activities: (KI, NILU, MOVATION) Develop project information for the web pages and other passive dissemination channels, and identify active dissemination activities. Promote liaison with other relevant project activities. Identify events (conferences and trade fairs) and suitable contributions to them from the project. All partners will contribute as appropriate.

T5.4 Additional partner contact: (KI, MOVATION) Follow up on established contacts with authorities (Oslo and Skedsmo local administrations, Akershus regional administration, Ruter regional public transport company, Vegvesenet national public roads authority, Norwegian Asthma and Allergy association). All partners will contribute as appropriate.

T5.5 Exploitation activities: (KI, MOVATION) This task will identify potential partners' exploitation of the project results (OperaSoftware, Telenor, others), and will establish and

maintain contacts with them. It will also develop an exploitation plan, and make sure that the necessary agreements are initiated. Through the entrepreneur network MOVATION will drive expectation forumaltion.

Table 2 Overview of the dissemination and exploitation activities

No	Strategy	Activities	Target group
1	Disseminating project results	Project website	Society/General public
2	Presenting scientific findings	Publications Presentations Knowledge transfer	Scientific community Policy and decision-makers
3	Transferring knowledge to industry	Press conference Industry workshop Press releases	Health organizations Environmental organizations Labour security companies Electronics industry ICT industry Sensor industry
4	Transferring results to users and industry	Demonstration Press Release Industry Workshop Training for users	Authorities Health organizations Environmental organizations Labour security companies Electronics industry ICT industry
5	Exploiting project results	Evaluate services Patent filing Commercialization Business Model Development	CITI-SENSE-MOB industrial Partners Associated partners Other industry

Deliverables

D5.1 Population of project portal content and project brochure (M3)

D5.2 Project meeting minutes and **Annual Reports** (M1,M4, M7,M10,**M13**,M16, M19, **M24**)

D5.3 Dissemination plan (M6)

D5.4 Exploitation plan (M18)

4. METHODOLOGY

4.1 Methods of implementation

The implementation will follow a phased approach. In phase 1 an adaptation of CO_2, NO_x and PM sensors for mobile (vehicular) platforms will be performed. A sample of vehicles will be equipped with the adapted sensors. Air pollution and environmental sensors for CO2, NOx and PM will be based on the sensors ability to communicate with mobile devices: Commercial micro-sensor types considered include those from: IA-Envira (CO_2, NO_2, CO and O_3), Synkera (ProKera and MikroKera solid state gas sensors); Shinyei Technology (humidity & particles); Libelium (incl. CO, CO_2, NO_2, VOCs, temperature., humidity and atmospheric pressure); Cairpol (incl. O_3/NO_2). Alphasense CO_2, CO, NO_2 and PM. These sensors have been integrated, with GPS for position and GPRS/Bluetooth for data communication, into both mobile and static sensor network systems which have been deployed in the UK, Europe and Africa.

In phase 2 the pilot implementation will take place on selected vehicles. These vehicles will be some of the buses that are a part of the Oslo public transportation system. Ruter A/S is the party responsible for managing, marketing and enabling the availability of public transportation in Oslo and Akershus Kommune (counties.) The application will then be made available for use in other locations through the CITI-SENSE exchange mechanism.

Several of the project developments will be provided through mobile application development. Additionally, through the CWI network of 3500 students, who will be invited to thesis work, as well as summer schools for socialtainment-based applications, we anticipate considerable innovation and development of downstream applications.

4.2 Reasons for the proposed methodology

CITI-SENSE-MOB will use the data access services and other technological components of not only CITI-SENSE, but also of other projects, such as ENVIROFI, a successful FP7 project working within the FI-PPP program. To begin with, we will focus on the local specific development of mobile services in the Oslo region in Norway and will extend from there towards other areas in Europe. The main applications will be related to outdoor air quality and transport emissions with a focus on the individual.

Further, our approach is to extend the usage of vehicles into “social mobility”: From Entertainment through Infotainment to Socialtainment. The social aspects “it is fun”, “we enjoy travelling together” of the social mobility scenario are addressed through the socialtainment equipment in the vehicle, linking together yourself and your friends and colleagues from your trust network. The new electrical bike from Opera Software is an example of “sharing with your social network” and this concept will be applied in new ways to develop new products as part of the ‘summer intern program’ planned.

Although data assimilation concepts are being applied within the GMES initiative, they (and data fusion concepts) have yet to be applied to the environmental information provided at the citizen level, notably concerning air pollution, meteorology and environmental conditions. Thus, there exists an opportunity to apply such concepts to quantitative information provided to citizens and qualitative information provided by citizens (for example, “it's hot”), notably through the use of micro sensors, mobile phones, and static and mobile networks. These data and networks could be assimilated in conjunction with the data provided by established European systems. The use of data assimilation to add value to the quantitative and qualitative information used by citizens, and quantify the errors associated with this information, would fill a gap in current capabilities in environmental monitoring. The technology can also be

used by European cities to validate their compliance with EU environmental and air quality standards.

Through these activities, CITI-SENSE-MOB aims at creating an entirely new service sector, based on a high technology and knowledge production environment, and drawing on the latest research results both for service content, and for technological solutions. This will support the need to provide to society both accurate and scientifically defendable information that will enable people to adapt to environmental challenges through making informed decisions that can impact their quality of life.

4.3 How the project intends to build on a previous projects or previous activities

The background for this project is several precursor projects which have helped to define the relationship between health, environment, and the public. HENVINET, SWING, ENVISION, ENVIROFI and PESCADO are EU FP6 and FP7 funded projects which have been instrumental in developing the infrastructures (such as FI-PPP, FI-WARE with ENVIROFI) which are key to this proposal's success. CITI-SENSE-MOB will build on these projects and at the same time, address two of the broad challenges that are the basis for HORIZON2020: Human Health and Well Being, and Climate Action. CITI-SENSE-MOB's aims are to establish ***an integrated citizens' environmental health monitoring system*** that is societally useful. The project will accomplish these targets by working directly with citizens, their groupings and representatives, and with the representatives of the established environmental health information collection systems, and identifying their issues, interests and needs. Oslo Municipality's directorate of the environment has expressed their direct interest in the project and already collaborations have been initiated on how to further improve the requirements and wishes from the end user point of view.

CITI-SENSE-MOB will be developed in parallel to the FP7 project CITI-SENSE. The concept of CITI-SENSE rests on three pillars:

- technological mobile platforms for distributed environmental health monitoring
- information and communication technologies
- societal involvement

In the CITI-SENSE project, pilot case studies in 9 locations across Europe will focus on a range of services related to environmental health issues of societal concern: combined environmental exposure and health associated with urban air quality; noise and development of public spaces; and indoor air at schools. Different solutions will be developed, shared through a common exchange mechanism (the Citizen's observatory and knowledge base). Attention will be given to the representativeness of citizen participation. The case studies will be based on distributed data collection using innovative static, portable and personal devices (low-cost reliable micro-sensor packs) that communicate with a data repository through mobile phones or other mobile devices. Participatory methods, data management strategies, and applications to facilitate exploitation of the data and information for policy, and society, will be developed. The GEOSS common protocols and standards will be utilized.

In the private sector a number of applications and mobile apps have been created as a result of open data initiatives. In Norway this includes applications ranging from real-time public transportation information, which was an outcome of the FP7 funded, Planet Data project, as well as applications for snow and ski conditions, the location of electric car charging stations, weather forecasts and many more. Common to all these services is that they use only one source of open information.

The overall goal here is to invoke the citizen's own interest in environmentally friendly behaviour, so one of the considered outcomes of the CITI-SENSE-MOB project would be to combine the use of transportation data (e.g. public transportation, electric cars parking lots, bikes stands) to events (e.g. concerts, art galleries) while including other decision relevant real-time information (e.g. forecasts, traffic messages). This downstream application will be made as a mobile device, or phone application, and will not only provide the public with the necessary information to make informed decisions, but will also provide data on the impact those decision have both on the environment, and on their own health.

4.4 Procedures for internal evaluation

Internal procedures for the management of large projects are well defined in the respective organisations participating in this project. These include project reporting (time/costs), QA review of the project, including documentary evidence, and strict adherence to ISO 9001 standards. All personnel involved are chosen due to their experience and are qualified to perform the tasks assigned. All work performed is overseen by a project manager with relevant experience.

4.5 Level of involvement and activity of other participants in the project

Oslo County, Akershus Fylkeskommune (local and regional administration), Statens Vegvesen (Public road administration) and Ruter (regional public transport company) and Norwegian Asthma and Allergy Association (NAAF) have been contacted and have expressed interest in the project. This will further be followed, and a financial contribution will be negotiated. Opera Software, Google and Telenor will be contacted to increase impact of the project.

4.6 Role of each participant

Kjeller Innovation (KI) will coordinate the project administratively and be in charge of exploitation planning and stakeholder contact. They will use their knowledge in commercializing collaborative research to establish the demonstrator.

SINTEF ICT aim at providing their SensApp platform with enhancement for mobile sensors for integration with the GEOSS-based architecture and platform from the CITI-SENSE project. They will lead WP4.

UNIK will contribute supervision and time of master and PhD students working on the service creation aspects of GMES-based monitoring and information.

NILU will coordinate the project scientifically, establish the sensor network, lead the service development, and contribute to all elements of the project. They will lead WP1, 2, 3 and 5.

Movation will use their knowledge in collaborative research to include companies like Opera Software, App providers like Telenor and other partners to contribute to a project with real-world impact.

4.7 Team proposed for implementation of the project

CITI-SENSE-MOB is creating a Citizens' Observatory Toolbox (COT), applying novel use of sensor technologies as one instrument of empowering citizens in the Oslo area within Norway to influence local decision making on environmental issues. This requires an inter-disciplinary approach, merging scientific knowledge with technological know-how and participatory governance against an inter-cultural background.

The CITI-SENSE consortium can fulfil these requirements. It is composed of 5 diverse partner organizations from Norway, providing a unique collaboration between research, SMEs and user organizations creating an Oslo region citizens' observatory toolbox and

innovative participatory processes. The specific and complementary expertise in the team is distributed as follows:

- Research (NILU, SINTEF)
- Academia (UNIK)
- SME (Kjeller Innovation, Movation)

The partners have expertise in all aspects of the project, ranging from sensing and communication technologies to information products and services, empowerment and citizens' participation to dissemination and exploitation. The also have a history of previous successful collaboration. The collective expertise present in the consortium is a key success factor of this proposal. Finally, the project will benefit from the extensive networks in the specialist fields of the partners.

As a strong project coordinator with substantial experience, Pål Midtlien Danielsen (Kjeller Innovation) will lead CITI-SENSE-MOB to a successful completion. Kjeller Innovation is a regional innovation company.

Table 3 Experience and roles of CITI-SENSE-MOB key personnel Partner

Partner	PIs	Role	Professional competence
Kjeller Innovation	Pål Midtlien Danielsen	Coordinator WP5 task 4-5 leader	Innovation and commercialization related to RTD activities; management and development of start-up companies
	Else Pran	WP 5 Leader WP5 task 1,3 leader	Director of Innovation at KI
	Anette Gangnæs	WP5 Contributor	Market Coordination at KI
NILU	Alena Bartonova	WP 5 task 2 leader	Experiences on coordination of large multi disciplinary collaborative research projects (EC RTD FP6 and FP7). Expert in environmental health impact assessment.
	Mike Kobernus	WP 4 task leader WP1 task 1 leader	Expert on Environmental Informatics, web based tools and web communication protocols.
	Hai-Ying Liu	WP 1 leader	Experience on integrated approach to monitoring for environmental health impact assessment. GIS mapping, Environmental and exposure modelling
	Núria Castell	WP 2 leader	Expert on local air quality, technologies and air quality modelling
	Franck Dauge	WP3 Leader	Air quality monitoring expert, monitoring technologies and reference laboratory
	Berit Modalen	WP5 contributor	Executive secretary
SINTEF	Arne Berre	WP 4 leader WP1 task 3 leader WP 2 task leader	Informatics; Technical manager and scientific coordinator for a number of ICT projects, e.g. COMPASS, OBOE, COMBINE, SWING, ENVISION and ENVIROFI. Leader of SINTEF CSI – Center for Service Innovation.
	Frank Fleurey	WP 4 task 2 leader	Informatics, responsible for the SINTEF SensApp platform
UNIK	Øivind Kure	WP 4 task leader	Network, information security and signal processing for communications;
	Zahid Iqbal	WP4 contributor	Security and privacy for cloud based enterprise collaboration services and administrating connected life group IT infrastructure.
Movation	Josef Noll	WP 1,4,5 contributor	Mobile Authentication, Wireless Broadband Access, Personalised Services, Mobile-Fixed Integration and the Evolution to 4G systems.