

The project is funded by:
**Ministry for Innovation and
Technology of Hungary**

Beneficiary:

COMPET-TERRA
Organising and Consulting

GIS to mitigate air pollution IN KoSovo



Project Details

Grant: *Climate change project preparation and capacity building activities in the Western Balkans region*

Beneficiary: *Compet-Terra Ltd.*

Title: *GIS to mitigate air poLlutlon IN KoSovo*

Project code: *21/WBGC-2020/1*

Project Area:

- *Municipality of Suhareka*
- *Municipality of Shtime*
- *Municipality of Prizren*

Project Details

Objectives

- *to provide Kosovo citizens with accurate information on implicit protection, environmental awareness and the environmental condition.*
- *to foster community building of local citizens, to achieve common goals regarding local environment.*
- *to assist government agencies in environment monitoring by establishing a crowdsourcing based environmental data collection in Kosovo.*

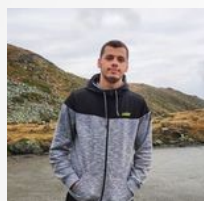


Project Details - Participants



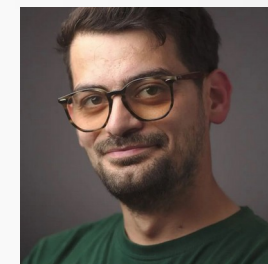
Project implementation management and ICT consulting

- *Support and lead the sensor development (microprogramming)*
- *Development the DB structure*
- *Development the system architecture*
- *Support sensor assembling and installation*
- *Support the knowledge transfer and data collection campaign*



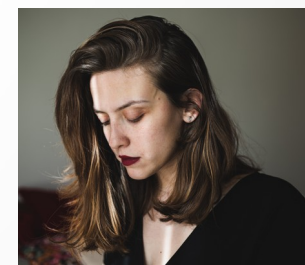
Sensor development (Air Quality Sensors) - Support the System development

- *Planing and development the sensor*
- *Microprogramming the sensors*
- *Support the other implementation units*



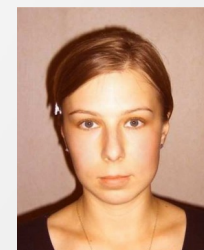
Platform development (GIS system – ConSenGIS)

- *Build ConSenGIS Architecture*
- *Development of Modeler Module*
- *Development of Map Server Module*



Support the project implementation

- *Manufacturing and testing sensor*
- *Commissioning the sensors*
- *Application to map Illegal Solid Wastes*
- *Knowledge transfer*
- *Implement Data collection Campaign*



Receptivity Potential of Kosovo

OPEN DATA
REPUBLIC OF KOSOVA

SHQIP SRPSKI ENGLISH

Log In Register

HOME DATASETS ORGANIZATIONS ABOUT SITE

Find Kosovo Government Open Data













We provide public data in open formats so that you can use, modify and share them. This data is yours. You can create visualizations, applications and great tools with them.

205
DATASETS

014
ORGANIZATIONS WITH DATA

Categories

Published datasets are tagged with relevant categories so you can learn about specific topics. Explore the data below.

 Government and Public Sector	 Education, Culture and Sport	 Agriculture
 Health	 Economy and Finance	 Justice and Security
 Procurement	 Population and Society	 Environment
 Transport and Infrastructure	 Science and Technology	 Politics

Kosovo is the youngest country in Europe, and has start give many attentions the open data and open source products, with the aim of facilitating the work, and make the life easier for its citizens.

Logics of the Project

AJDOS air quality sensors



ConSenGIS Platform



*Information on
environmental
condition*

*strengthen of climate
protection*



*reducing the
environmental
impact of cities*



Field data collection

to implement a local environment monitoring system, which is driven by volunteers contribution to data collection in order to

- *strengthen of climate protection,*
- *reducing the environmental impact of cities.*

Main parts

**Air Quality
Measuring Sensor
Design/assembling**

***Sensor type
selection***

***Sensor component
selection***

***Sensor
assembling***

**Air Quality
Measuring Sensor
Installation**

***Installation place
selection***

***Install the
sensor***

***Sensor
activation***

ConSenGIS platform

***Base
principles***

***Architecture
& database***

***Functions of
Platform***

Results

***Information on
environmental***




***Knowledge
transfer***

Upgrade

Air Quality Measuring Sensors



Sensor type selection - Compact VS Self-made




	AQMesh	AQY1	Gaia A12
Picture			
url	https://www.aqmesh.com/product/aqmesh	https://www.aeroqual.com/product/aqy-micro-air-quality-station	https://aqicn.org/gaia
PM 2.5 Sensors	YES	YES	YES
PM 10 Sensor	YES	YES	YES
PM x Sensor	PM 1	-	PM 1
Temperature	YES	YES	YES
Humidity	YES	YES	YES
Other sensor	Pressure	Dew point/Pressure	Pressure
LAN	NO	NO	NO
WIFI	YES	NO	YES
3G/4G/5G	YES	YES	NO
BLE	NO	NO	NO
Data Storage	Aeroqual Cloud data storage, or 32 GB Memory stick backup /	aqmeshdata.net	aqicn.org
Outdoor support	YES	YES	YES
Compact solution	YES	YES	YES
Power-supply	DC 12V	DC 9-24V	DC 5V
Documentation	YES	YES	YES

Air Quality Measuring Sensors

Air Quality Measuring Sensor Design/Assembly	Sensor component selection
Air Quality Measuring Sensor Installation	
Customized platform	
Results	

Sensor type selection - Compact VS Self-made

Microcontroller selection

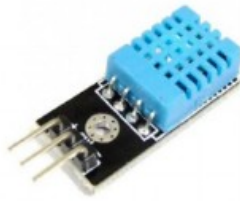



Family	Arduino	ESP8266	Raspberry
Picture			
Processor	ATmega	ESP8266	Broadcom BCM2837B0, Cortex-A53 64-bit
Clock	16Mhz	80/160Mhz	1.4 GHz
Memory	32kB — 512 kB	4 — 16 MB	512MB/SD Card
Power	5V DC	3,3V/5V DC	5,1V/2.5ADC
Consumption	20mA	40mA — ~ 20uA	> 500mA
Communication	UART	Wifi	Wifi/BLE/UART
Documentation	Good	Good	Good
Libraries	Good	Good	Good
Operating range	N/A	-20 — +75°C	0 — +50°C

Air Quality Measuring Sensors

Air Quality Measuring Sensor Design/Assembly	Sensor Component Selection
Air Quality Measuring Sensor Installation	
Arduino/GPIO platform	
Results	

Sensor type selection - Compact VS Self-made

- Microcontroller selection
- Temperature sensor





Type	DHT11	DHT22	BME280	DS18B20
Picture				
Temperature	YES	YES	YES	YES
Humidity	YES	YES	YES	NO
Pressure	NO	NO	YES	NO
Accuracy	+/-5%RH, +/- 2°C	+/-2%RH, +/- 0.5°C	+/- 1°C	+/- 0.5°C
Power	DC 3.5-5.5V	DC 3.5-5.5V	DC 1.8-5V	DC 3-5.5V
Consumption	0.3mA/60uA	0.3mA/60uA	0.16uA	N/A
Interface	One wire	One wire	I2C	One wire
Documentation	Good	Good	Good	Good
Libraries	Good	Good	Good	Good
Operating range	-40 – 80°C	-40 – 80°C	-40 - 85°C	-55 - 125°C

Air Quality Measuring Sensors



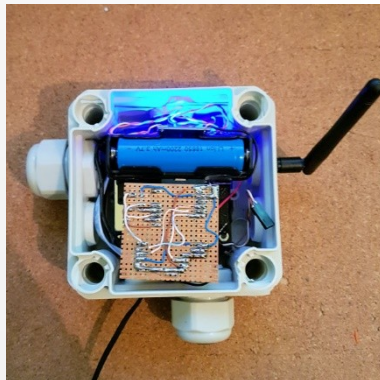
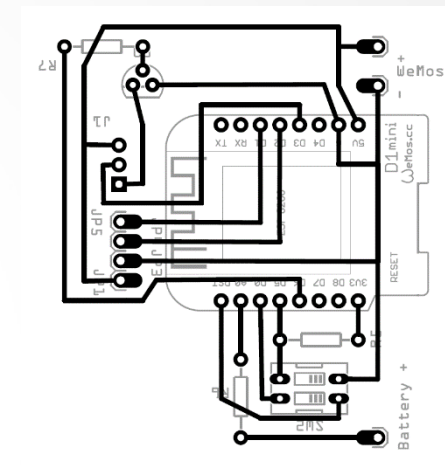
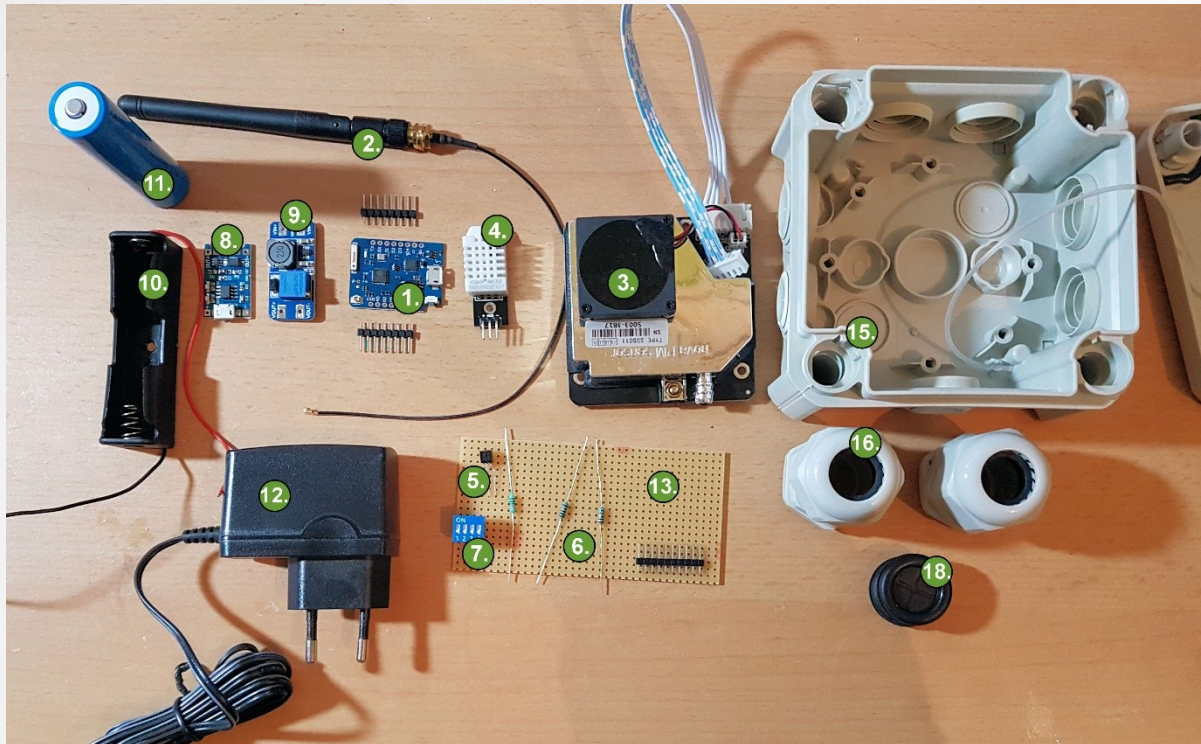
Sensor type selection - Compact VS Self-made

- Microcontroller selection
- Temperature sensor
- **PM sensor**

Type	HM3301	SPS30	SDS011	PPD42
Picture				
Datasheet	https://files.seeedstudio.com/wiki/Grove-Laser_PM2.5_Sensor-HM3301/res/HM-3300%263600_V2.1.pdf	https://cdn.sos.sk/productdata/98/89/92718144/sps30-2.pdf	https://cdn-reichelt.de/document/datenblatt/x200/SDS011-DATASHEET.pdf	https://files.seeedstudio.com/wiki/Grove_Dust_Sensor/resource/Grove_-_Dust_sensor.pdf
PM 2.5	YES	YES	YES	YES
PM10	YES	YES	YES	NO
PM x	PM5	PM 1, PM 4	-	-
Power	DC 3.3/5V	DC 4.5-5.5V	DC 4.7-5V	DC 5V
Consumption	75mA/150uA	65mA/50uA	70mA/4mA	90mA
Interface	I2C	UART/I2C	UART	PWM
Measuring time	30s/1s	8s/1s	10s/1s	60s
Accuracy	+/-10%	+/-10% (PM2.5) +/-25% (PM10)	+/- 15%	N/A
Operating range	-10 – 60°C	-10 – 60°C	-10 – 50°C	0 – 45°C
Documentation	moderate	Good	The best	Forums only
Libraries	NO	YES	YES	NO

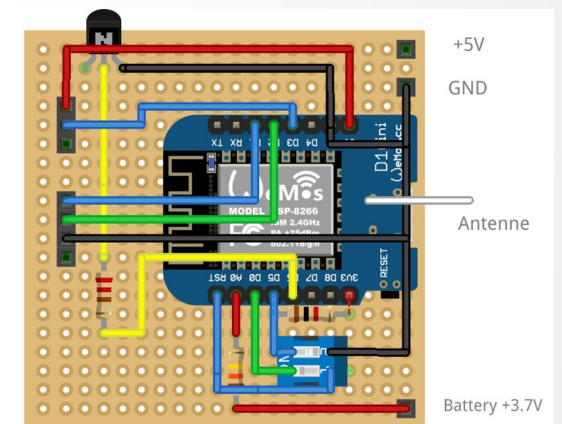
Air Quality Measuring Sensors

Air Quality Measuring Sensor	Done
Air Quality Measuring Sensor	
Arduino IDE platform	
Details	



DHT-22 +5V
DHT-22 GND
DHT-22 DATA

SDS011 TXD
SDS011 RXD
SDS011 GND
SDS011 +5V



Air Quality Measuring Sensors

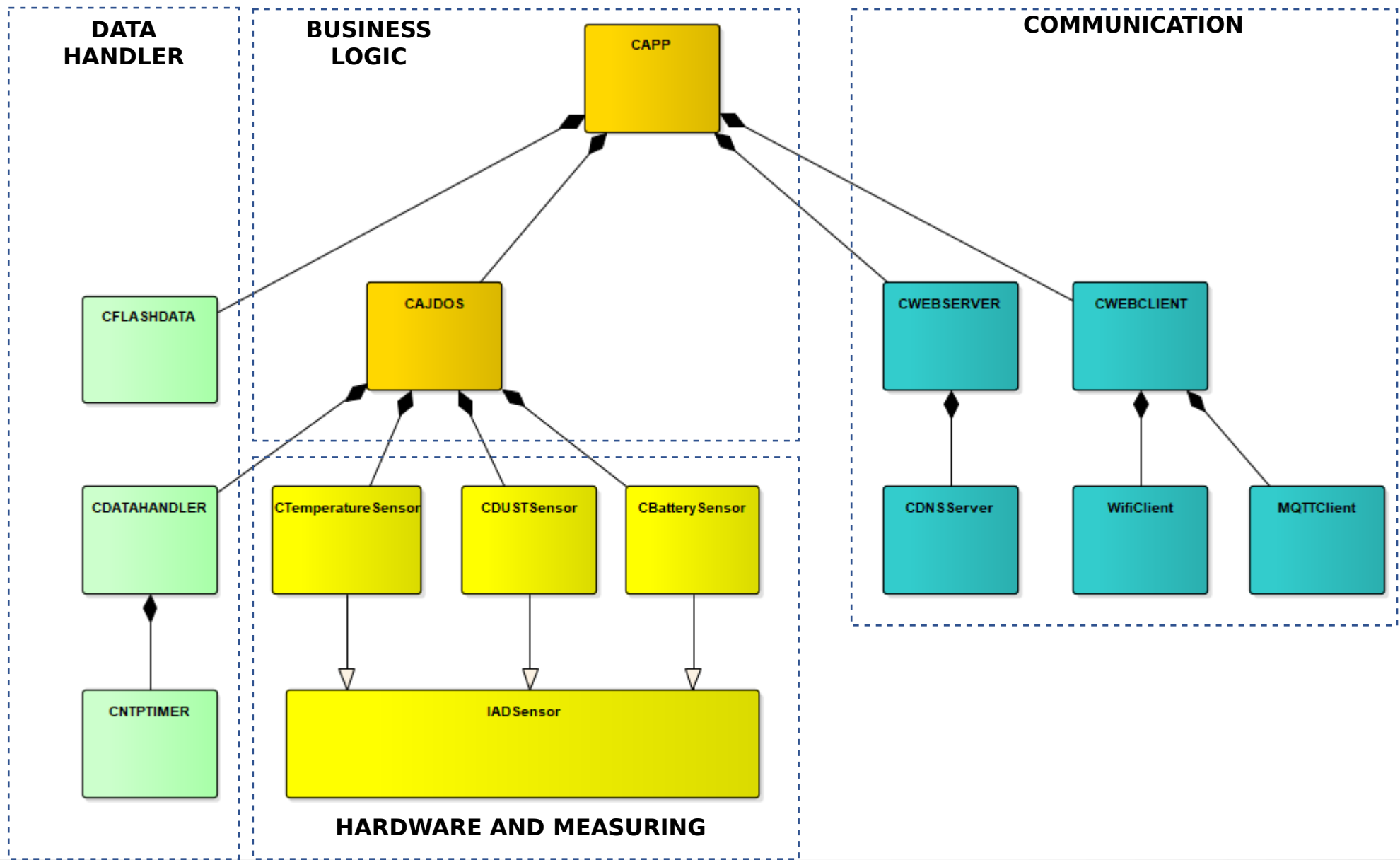
Air Quality Measuring Sensor	Introduction
Air Quality Measuring Sensor	Hardware
Arduino IDE platform	Software
Results	



Air Quality Measuring Sensors

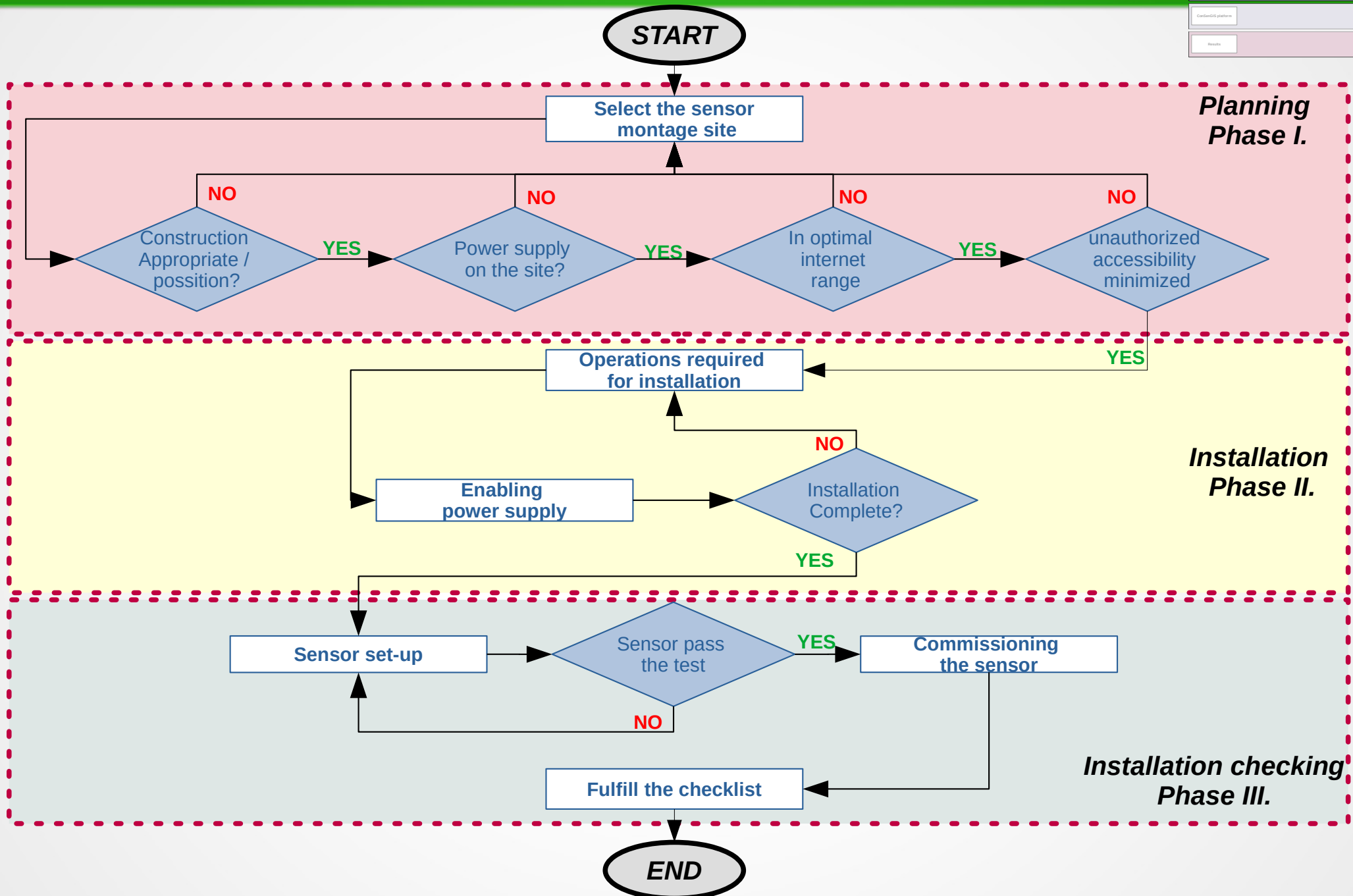
Sensor software Architecture

Air Quality Measuring Sensor	Device
Air Quality Measuring Sensor	Hardware
Confidential platform	
Details	

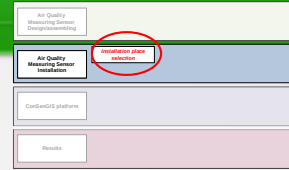


Sensor Installation

Air Quality Monitoring System Design/Implementation	
Air Quality Monitoring Sensor Installation	Installation plan selection
Construction plan	
Results	



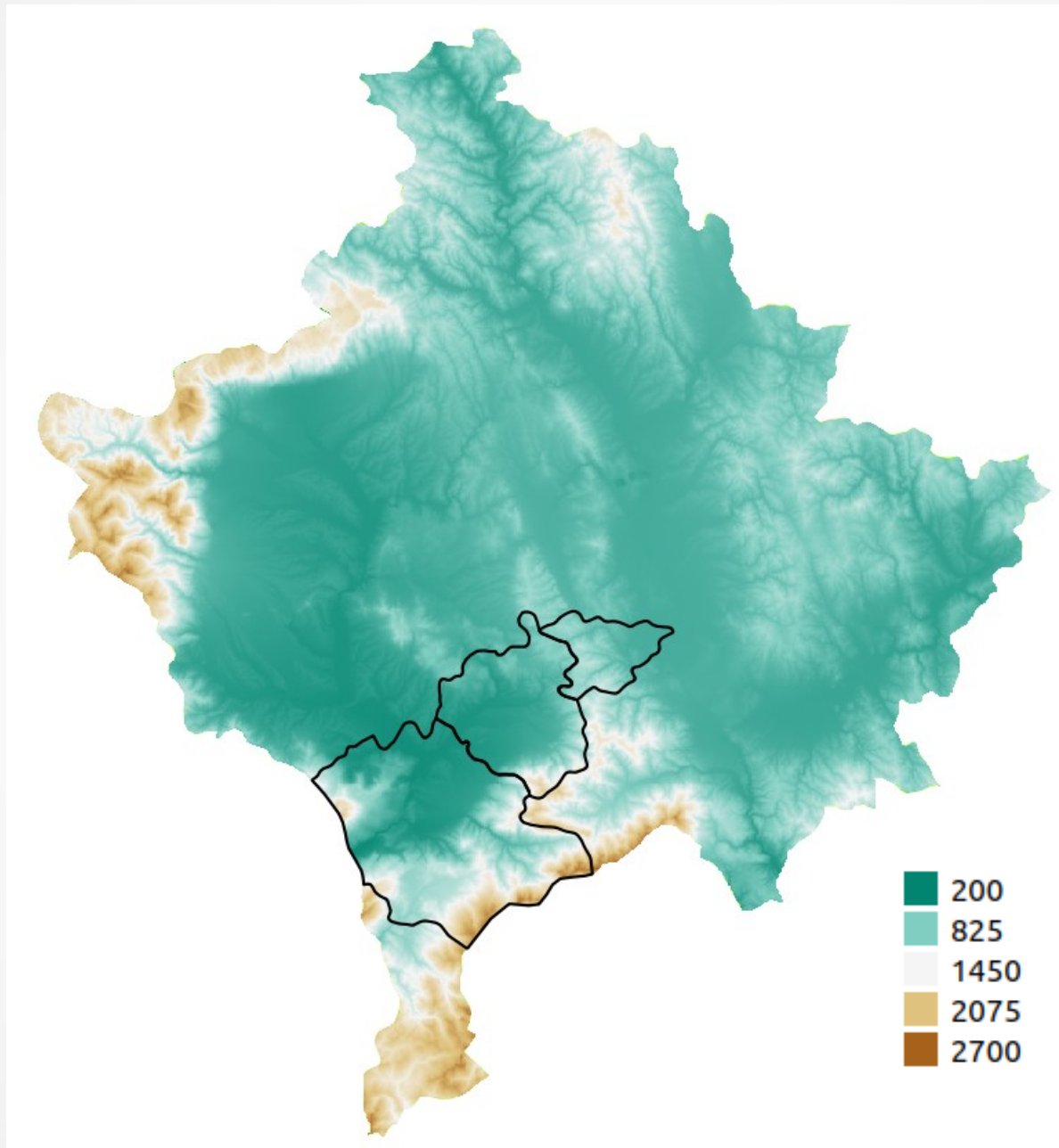
Sensor Installation - Phase I.



Introducing decision-making factors

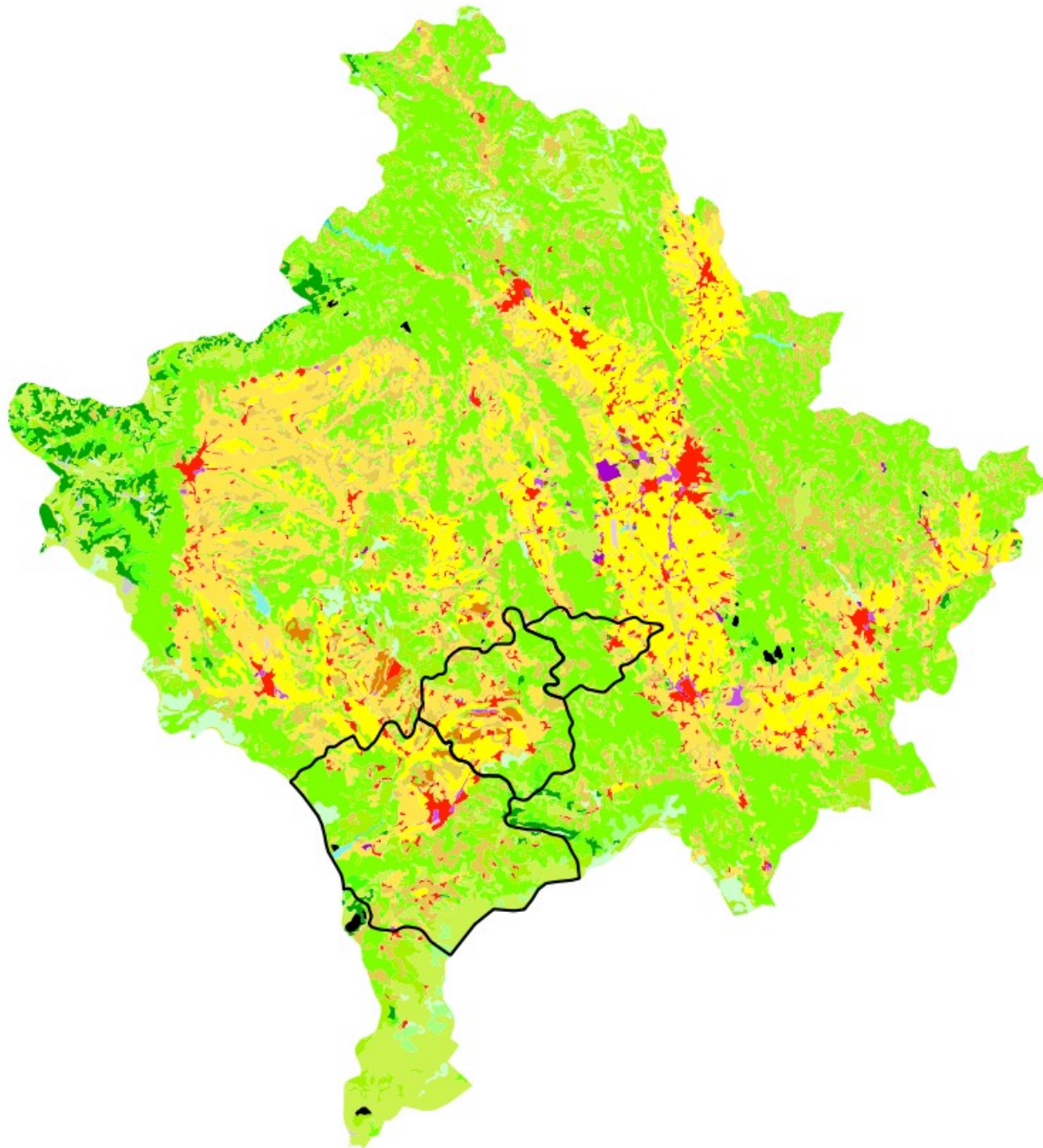
- **Managerial:**
 - *full cooperation of the municipality;*
 - *full cooperation with other relevant parties concerning the targeted building where the sensors will be installed;*
- **Geographical:**
 - *the location should be in strategic points so as to cover a wide territory within the municipality;*
 - *in some cases, where available, the sensors should be placed close to pollution sources that are known to the respective municipalities;*
- **Technical:**
 - *the WiFi access needs to be stable and strong;*
 - *the sensors need to have access to a stable power source*

Sensor Installation - Phase I.



Air Quality Monitoring Station	
Air Quality Monitoring Station Installation	Installation point selection
Coordinate platform	
Results	

Sensor Installation - Phase I.

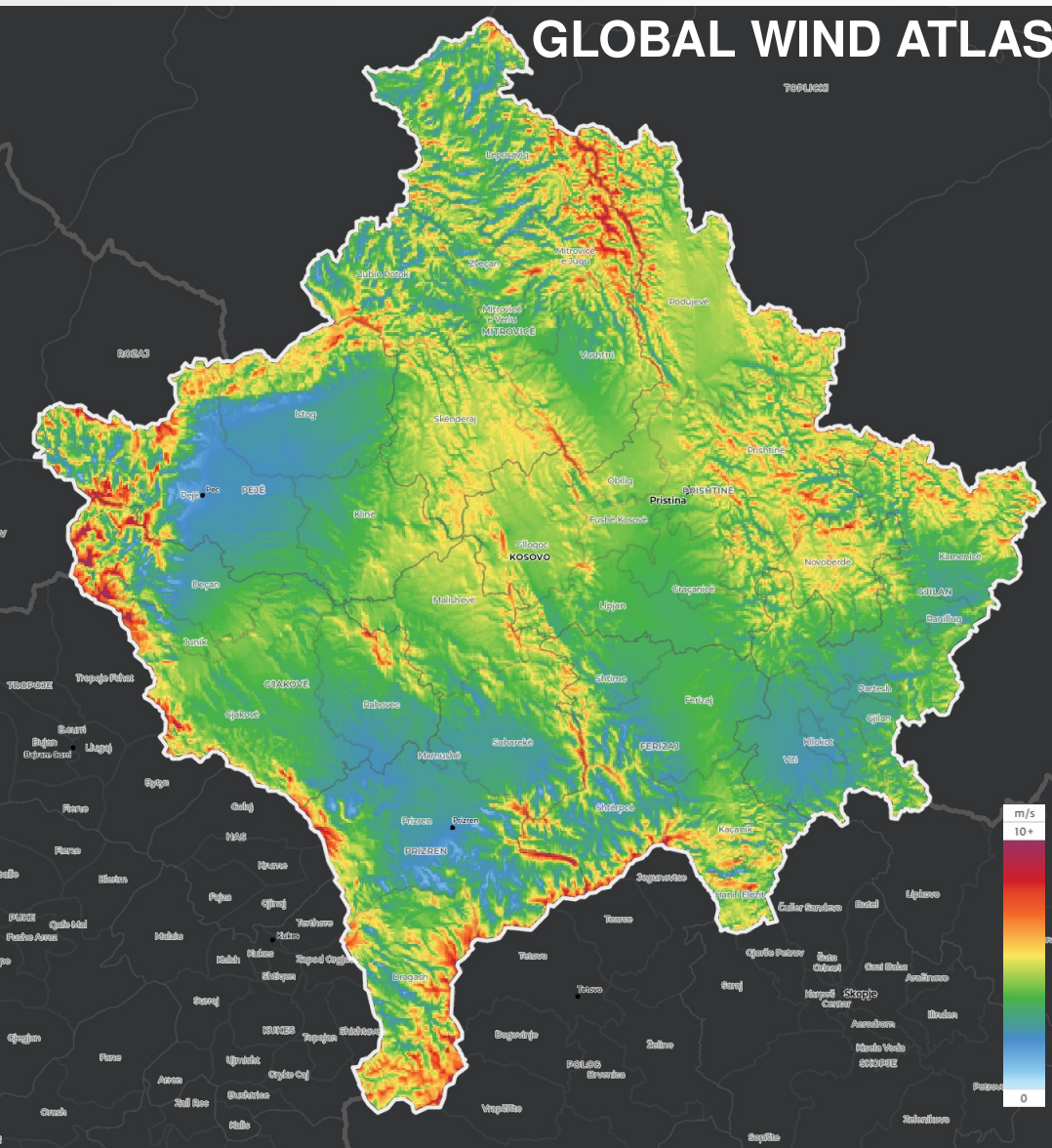


Air Quality Monitoring System Configuration	
Air Quality Monitoring Sensor Installation	<input checked="" type="checkbox"/> Installation point selection
Coordinate system	
Results	

- Continuous urban fabric
- Discontinuous urban fabric
- Industrial or commercial units
- Road and rail networks and associated land
- Airports
- Mineral extraction sites
- Dump sites
- Construction sites
- Green urban areas
- Sport and leisure facilities
- Non-irrigated arable land
- Vineyards
- Fruit trees and berry plantations
- Pastures
- Complex cultivation patterns
- Land principally occupied by agriculture, with significant areas of natural vegetation
- Broad-leaved forest
- Coniferous forest
- Mixed forest
- Natural grasslands
- Moors and heathland
- Sclerophyllous vegetation
- Transitional woodland-shrub
- Bare rocks
- Sparsely vegetated areas
- Burnt areas
- Inland marshes
- Peat bogs
- Water courses
- Water bodies

Sensor Installation - Phase I.

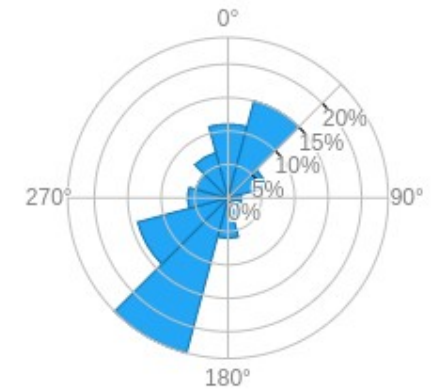
MEAN WIND SPEED AT 50m



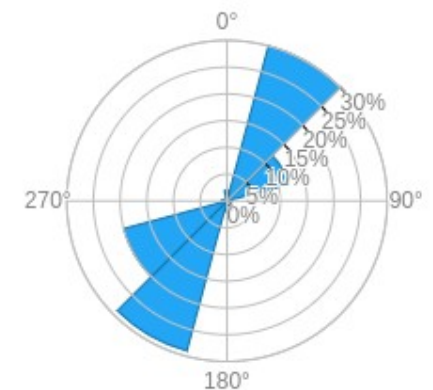
This map is printed using the Global Wind Atlas online application website (v.3.1) owned by the Technical University of Denmark.

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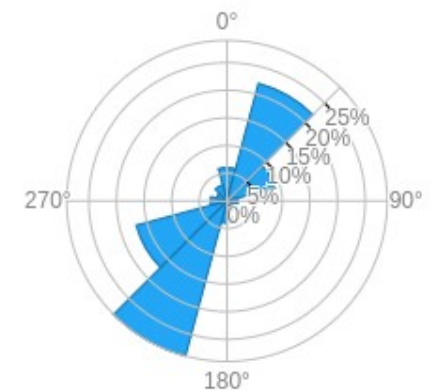
Wind frequency



Wind Power



Wind Speed



Air Quality Monitoring System
Background Information

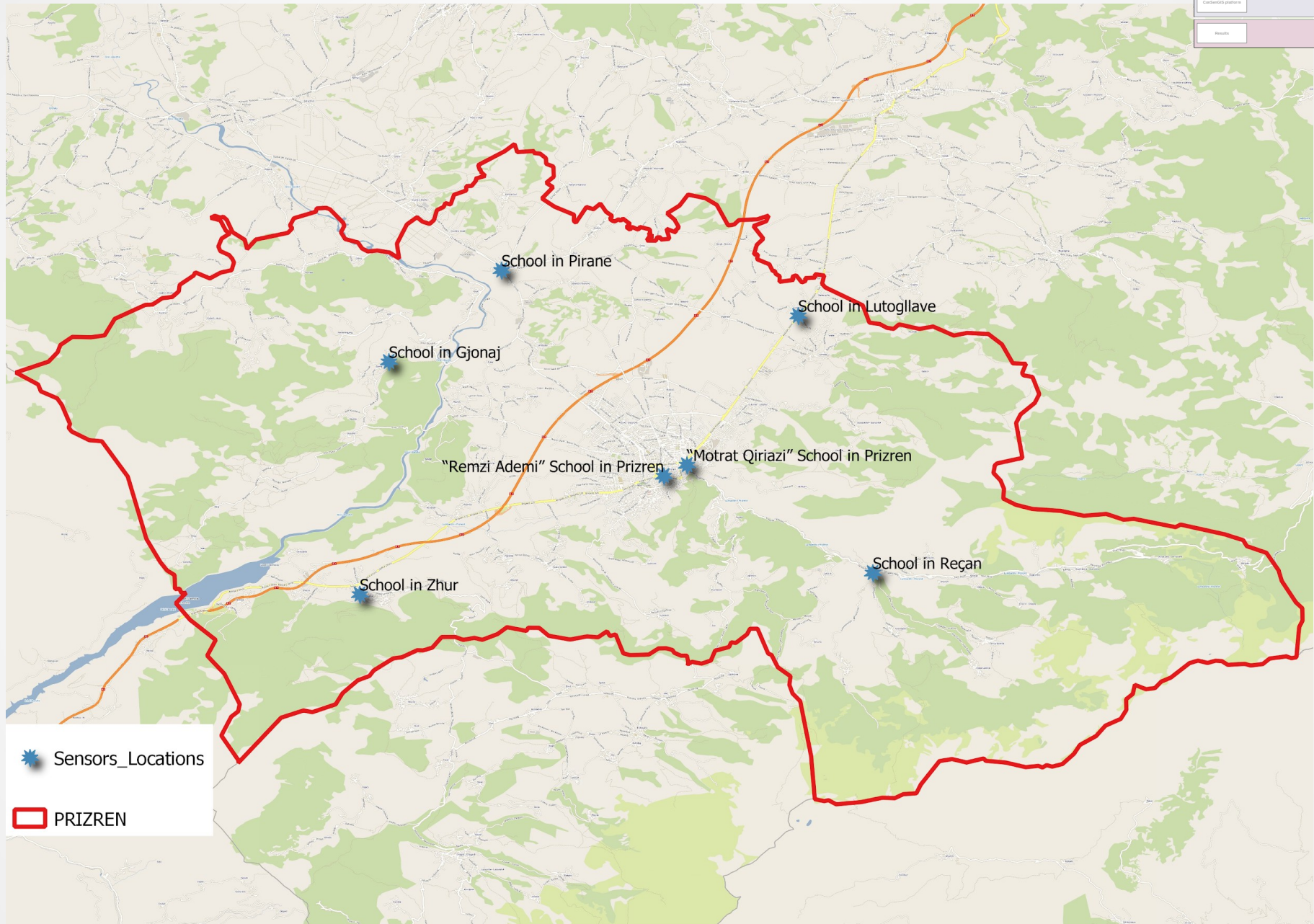
Air Quality Monitoring Sensor Installation

Coordinate system

Results

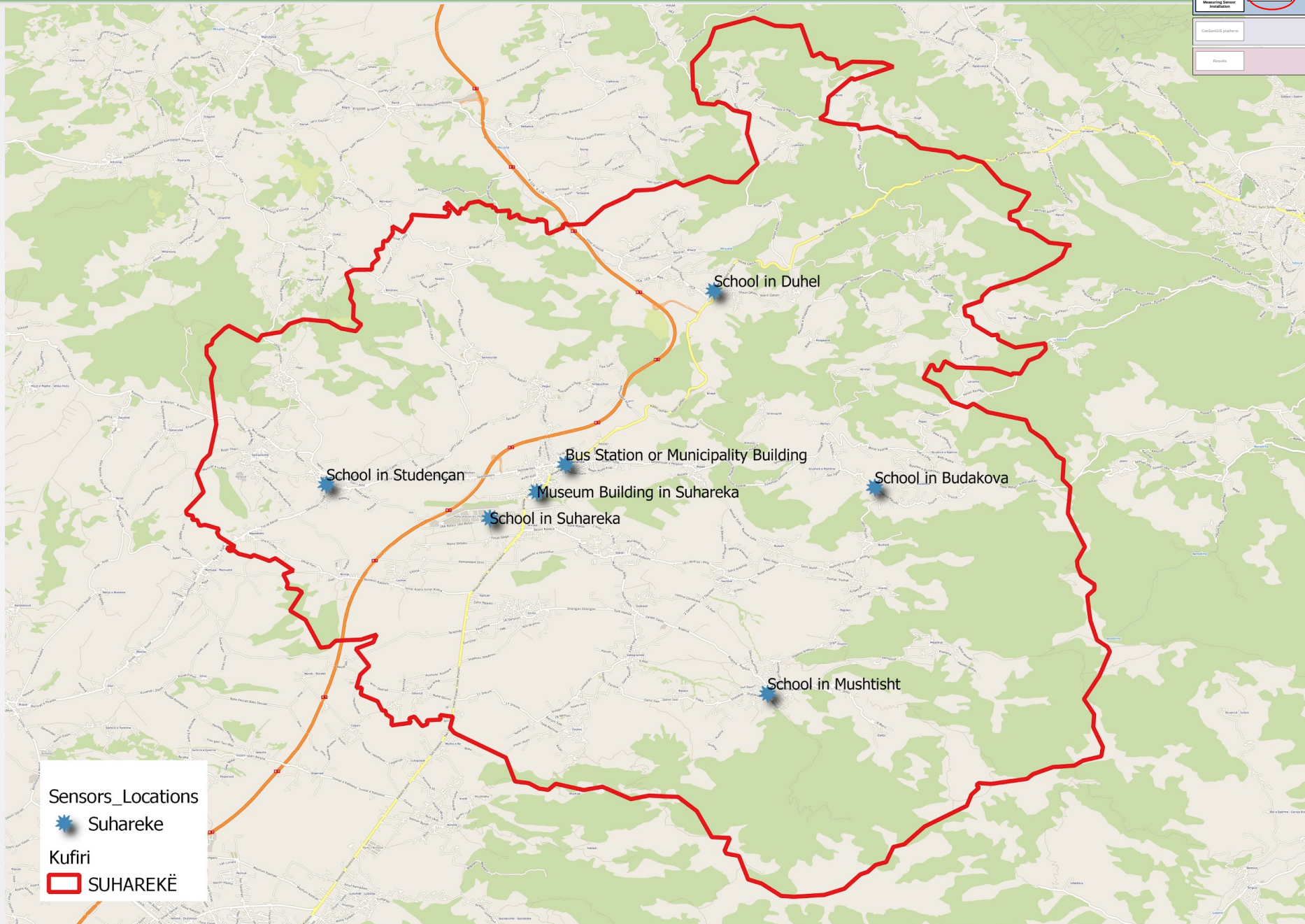
Sensor Installation - Phase I.

Air Quality Monitoring Station	Installation phase
Air Quality Monitoring Station	Installation phase
Installation phase	Installation phase
Installation phase	Installation phase

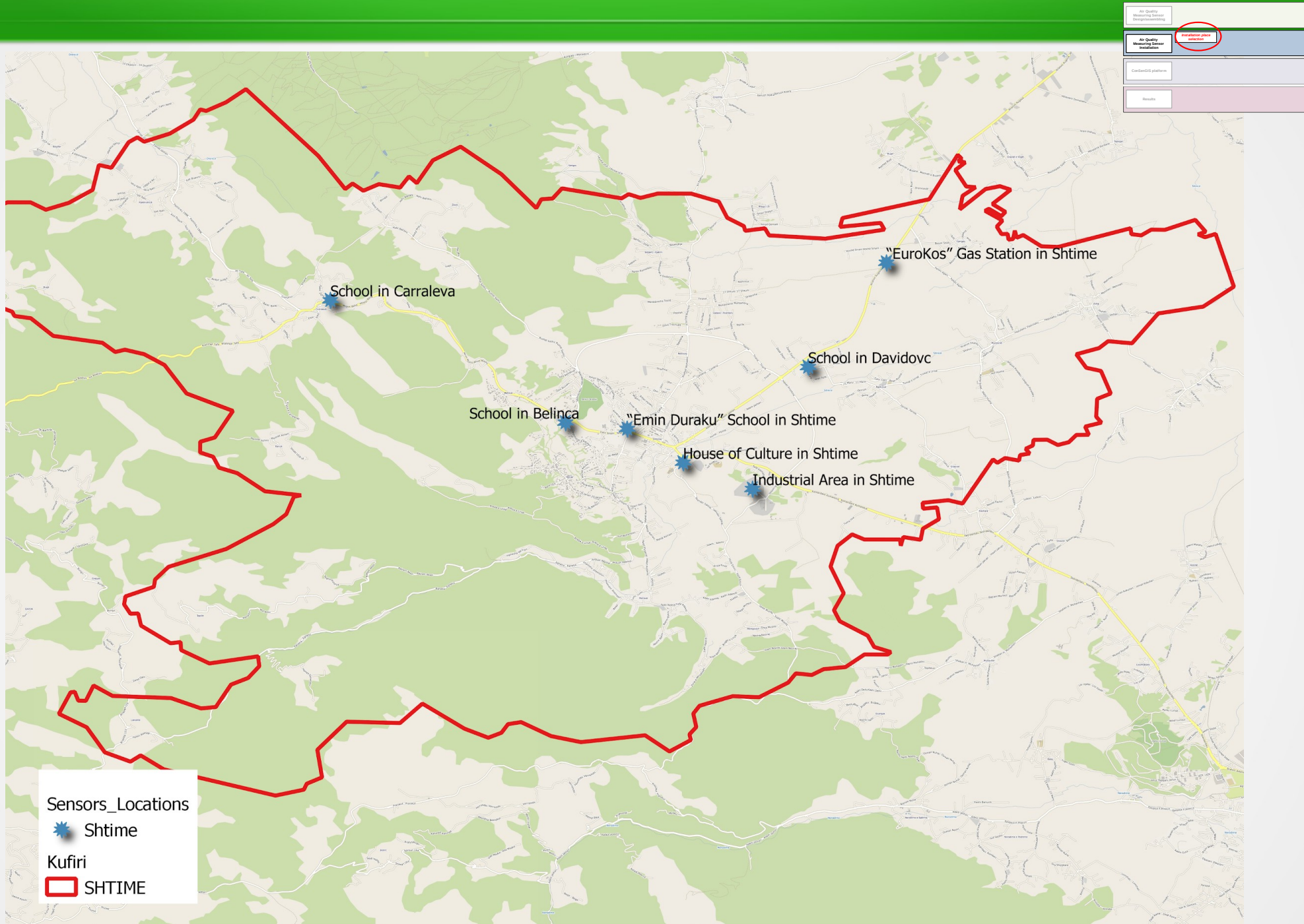


Sensor Installation - Phase I.

Air Quality Monitoring Station	Installation phase
Air Quality Monitoring Sensor Installation	Installation phase
Coordinate platform	
Results	

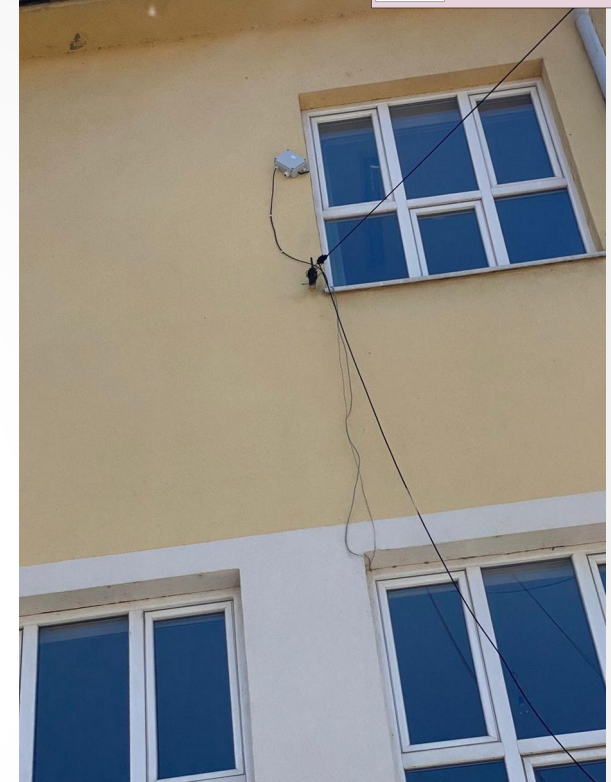


Sensor Installation - Phase I.



Sensor Installation - Phase II.

All Quality	Responsible Person	Bergmannsberg
All Quality	Measuring Station	Station 101
Confidentiality	Station	
Results		



Sensor Installation - Phase II.



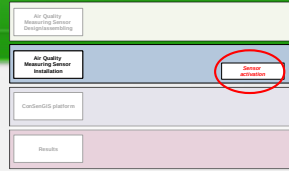
City/Town:	<i>Prizren</i>	Date	<i>15.06.2021</i>
Name:	<i>Shkolla "Motrat Qiriazi"</i>	Contact number	<i>0453144811</i>
Contact Name	<i>Sedat Shkurti</i>		

Information / Task to be performed	YES	NO	Comment related to task
Has the contact person changed?		X	
Is the place for installation easily accessible?	X		
Is the power supply easily accessible?	X		
Is the sensor mounted on a wall?	X		
Is the sensor mounted on a roof?		X	
Are Lat, Long and Z coordinates measured?	X		
Are Lat, Long and Z coordinates predefined?	X		
Is the M (height) measured?	X		<i>8m</i>
Is the WiFi connection set up?	X		
Is the WiFi access recorded to a notebook?	X		<i>Motrat Qiriazi kurilali</i>
Is the server data set up?	X		
Has the sensor passed the test?		X	
Is the MQTT message successfully sent?		X	

Problem description:

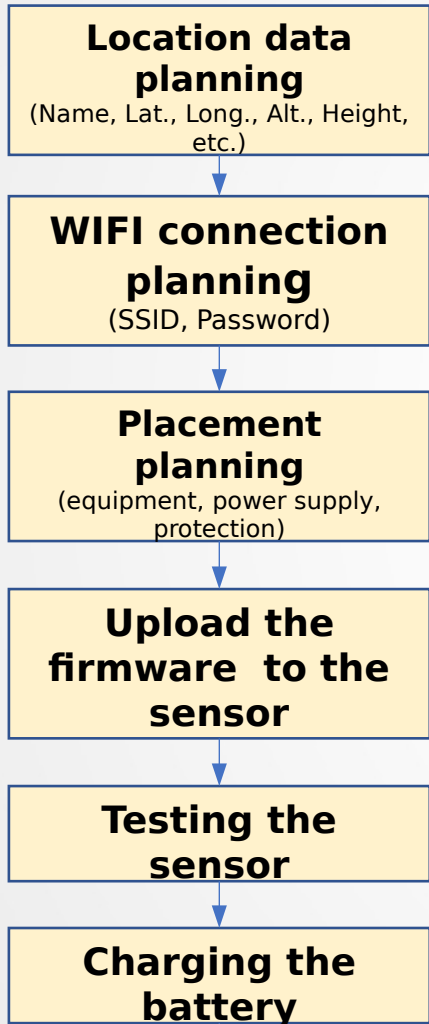
The school has Firewall blocking ports and it includes the MQTT Port.

Sensor Installation - Phase III.

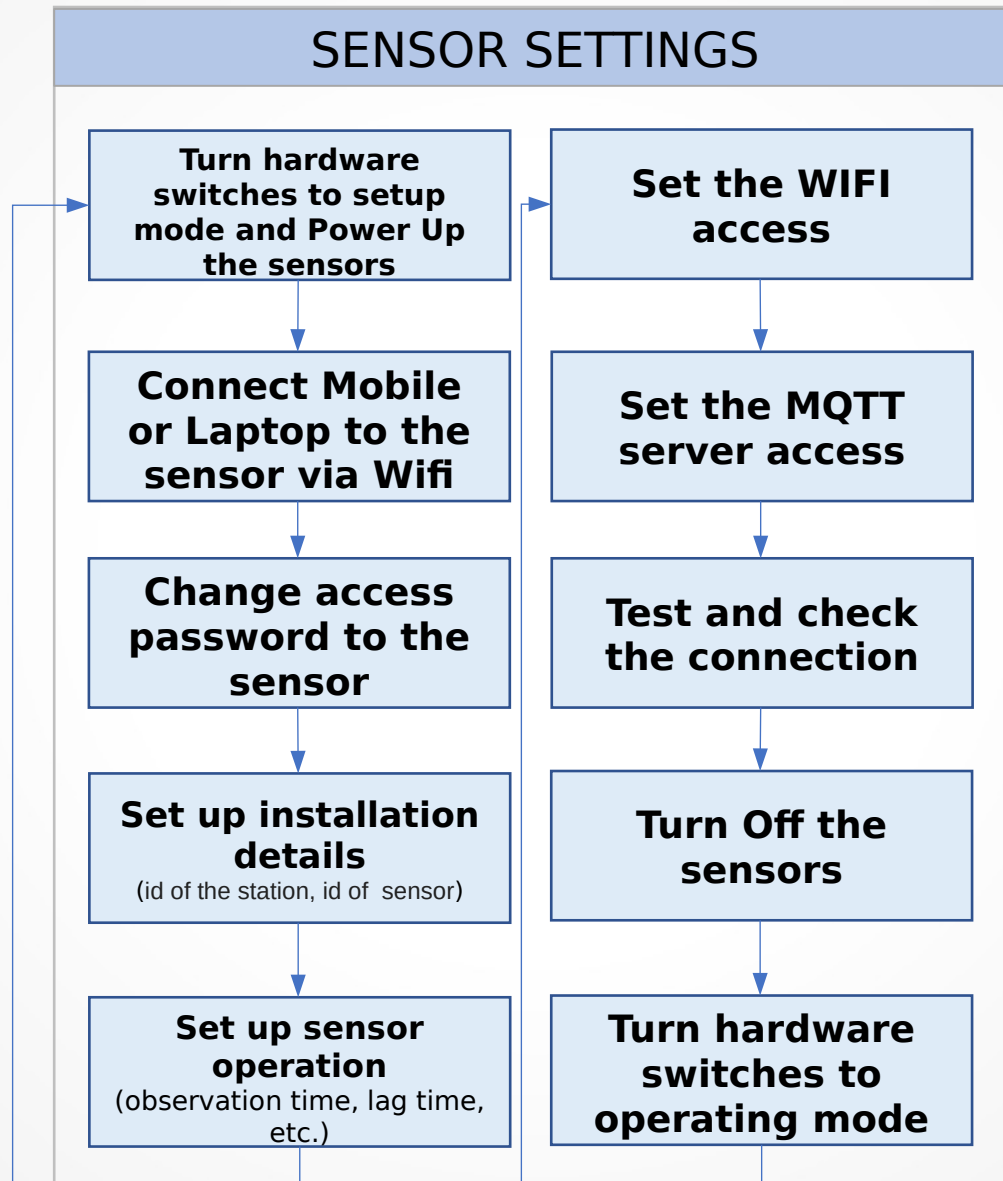


Sensor Settings on Mobile UI

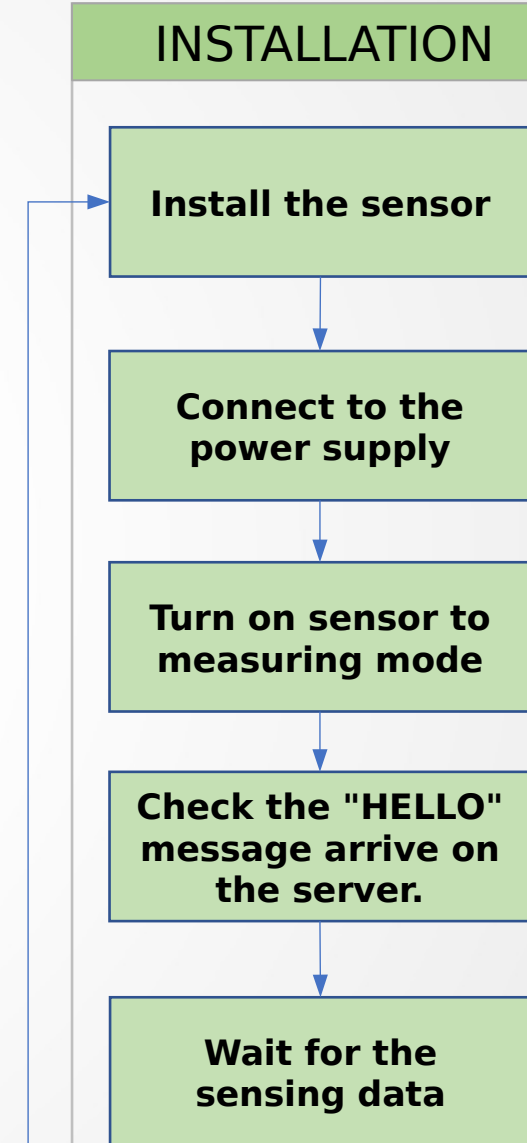
PREPARATION



SENSOR SETTINGS

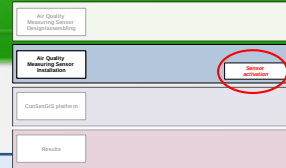


INSTALLATION



Sensor Installation - Phase III.

Sensor Settings on Mobile UI



Change access password to the sensor

Set up installation details

(id of the station, id of the sensor)

Set up sensor operation

(observation time, lag time, etc.)

The 'Configuration access' screen shows a form for changing the sensor's WiFi password. It includes fields for 'Original' (old password), 'New' (new password), and 'Again' (retype the new password). There is a 'Show passwords' checkbox and a green 'Save' button.

The 'Home' screen displays the sensor's name 'AJDOS AIR POLLUTION SENSOR v1.0' and a list of configuration details: Name (Test 3), Password (12345678), Owner ID (BG), Station ID (OpS-IN Office), Lat. (42.23169926), Long. (20.76129913), Alt. (1476.00000000), and Height (5.00000000). There are 'Refresh' and 'Save' buttons.

The 'Measuring' screen shows 'Measuring parameters' with a 'Specify measurement frequency' section. It includes 'Cycle' (60 minutes (30-1440)) and 'Lag time' (0 seconds (0-180)). There is a green 'Save' button.

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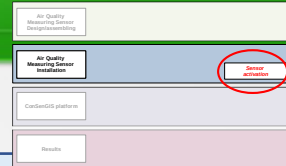
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Reboot

Reset

Sensor Installation - Phase II.

Sensor Settings on Mobile UI



Set the WIFI access

Set the MQTT server access

Test and check the connection

WIFI

WIFI Router

Authorization data for the Internet access

SSID

Password

Show available wireless networks

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Sending

Server access

The measured data will be sent here

Broker IP

Broker port

Username

Password

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Test

WIFI

MQTT

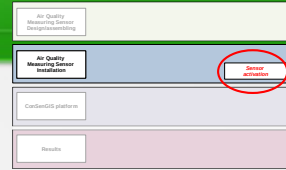
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Sensor Installation - Phase III.

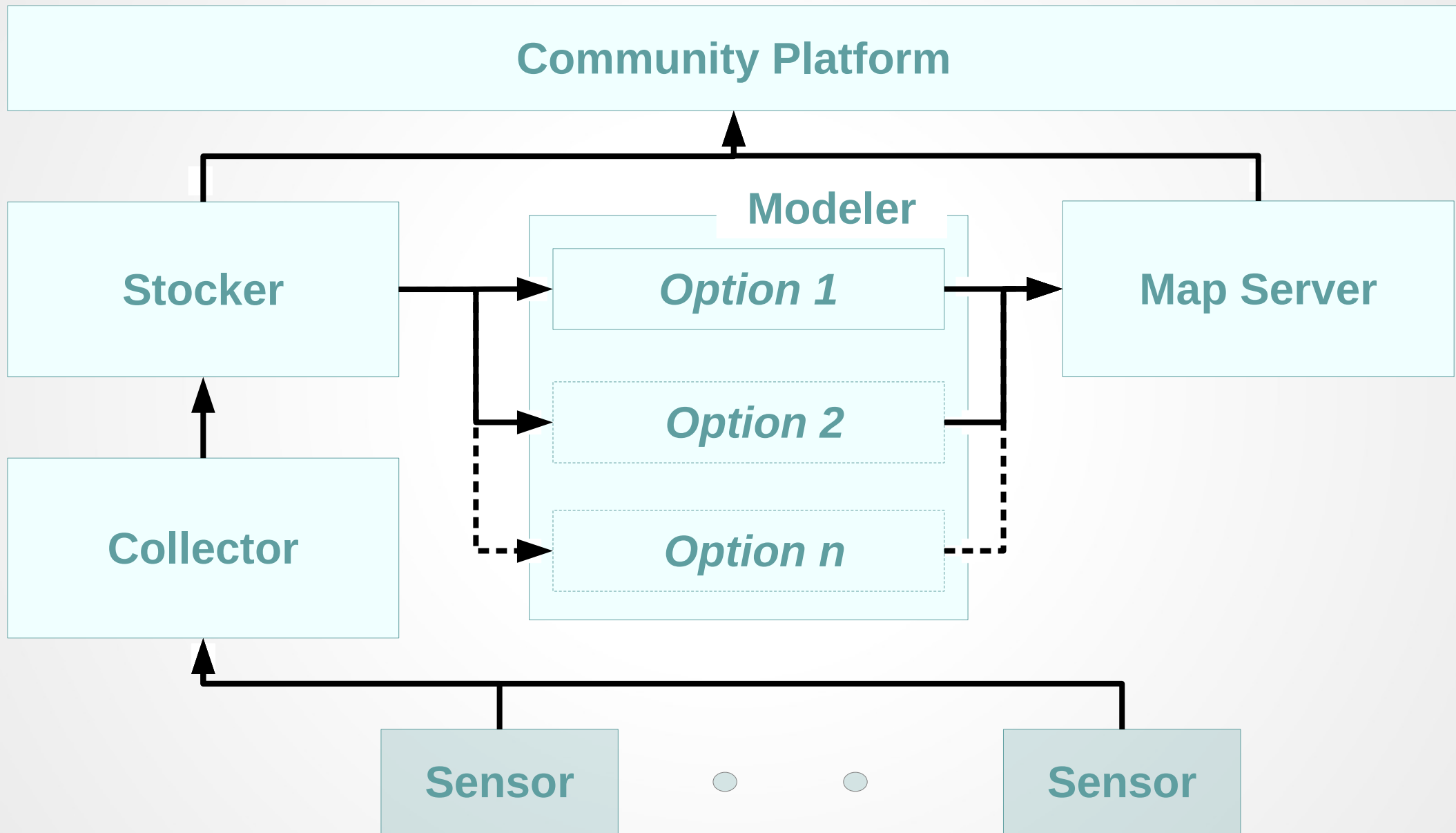


MQTT-message

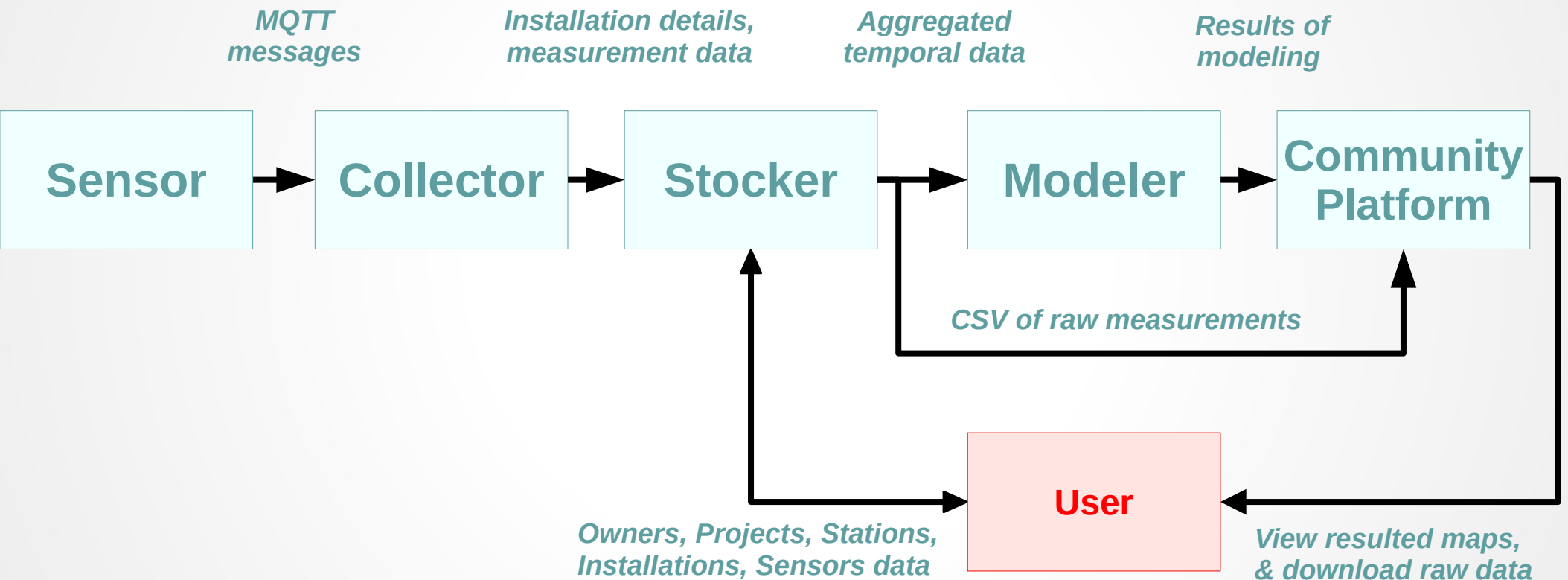
Name	MQTT topic	Payload
<i>hello</i>	/ajdos/sensor/hello	<pre>{ "name": "<sensor name>", "publickey": "<password>", "owner": "<owner_id>", "station": "<station_id>", "location": "POINT(<longitude> <latitude>)", "cycletime": <cycle-time> "time": "<timestamp>" "crc": "<access-key>" }</pre>
<i>bye</i>	/ajdos/sensor/bye	<pre>{ "name": "<sensor name>", "publickey": "<password>", "time": "<timestamp>" }</pre>
<i>data</i>	/ajdos/sensor/data	<pre>{ "name": "<sensor name>", "publickey": "<password>", "location": "POINT(<longitude> <latitude> <altitude>)", "values": { "temperature": <temperature_value>, "humidity": <humidity_value>, "pm10": <pm10_value>, "pm25": <pm2.5_value>, "battery": <battery_value> } "time": "<timestamp>" }</pre>

Functional Model

All Quality
Measuring Games
Design/Development
All Quality
Measuring Games
Installation
Candidate's platform
Base principles
Results



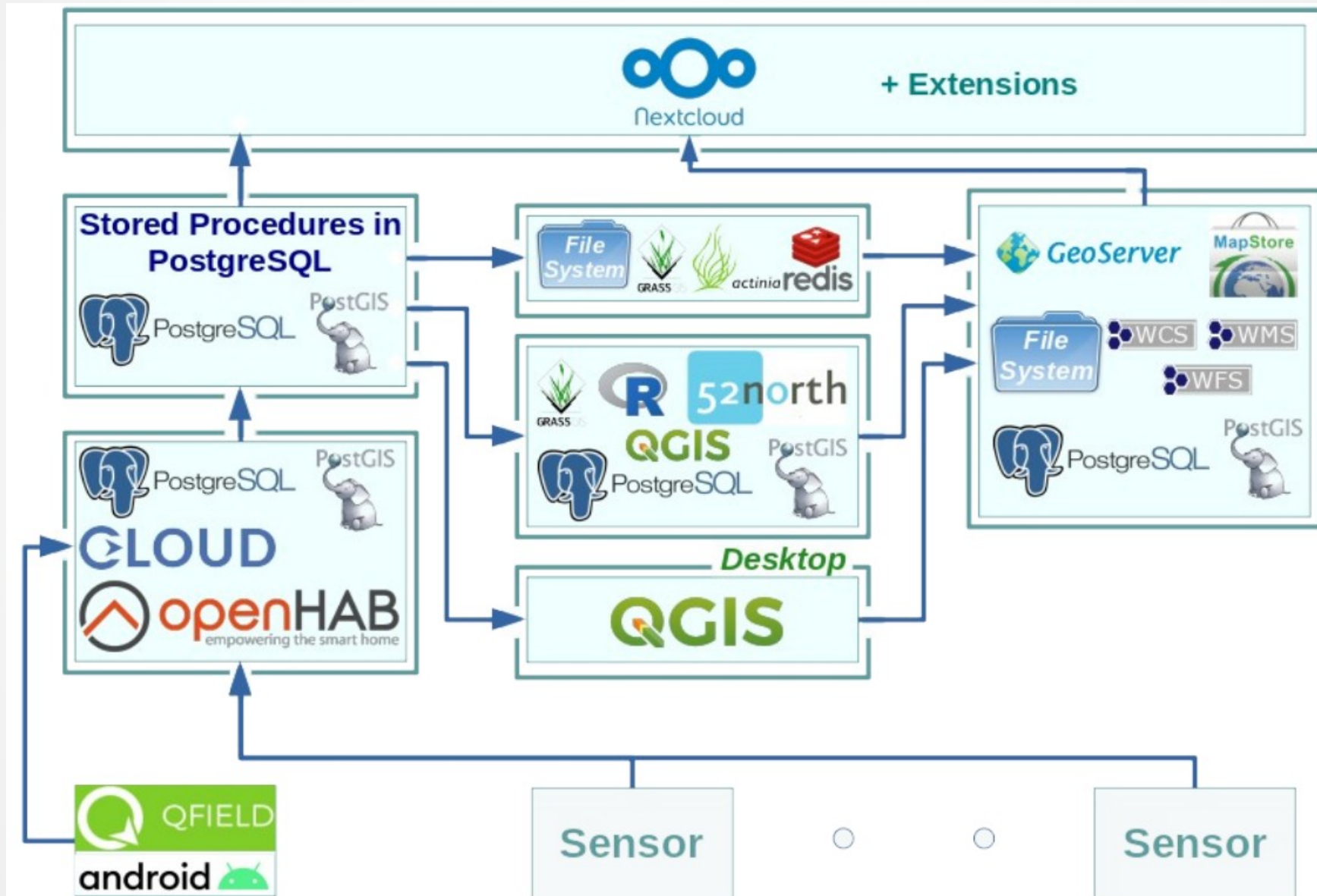
Overview of Data Flow Concept



ConSenGIS Platform - preliminary

ConSenGIS -> Consonance & Sensor & GIS

Air Quality Monitoring System	
Air Quality Monitoring System	
ConSenGIS platform	ConSenGIS
Results	



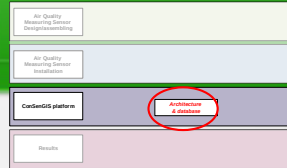
ConSenGIS Platform



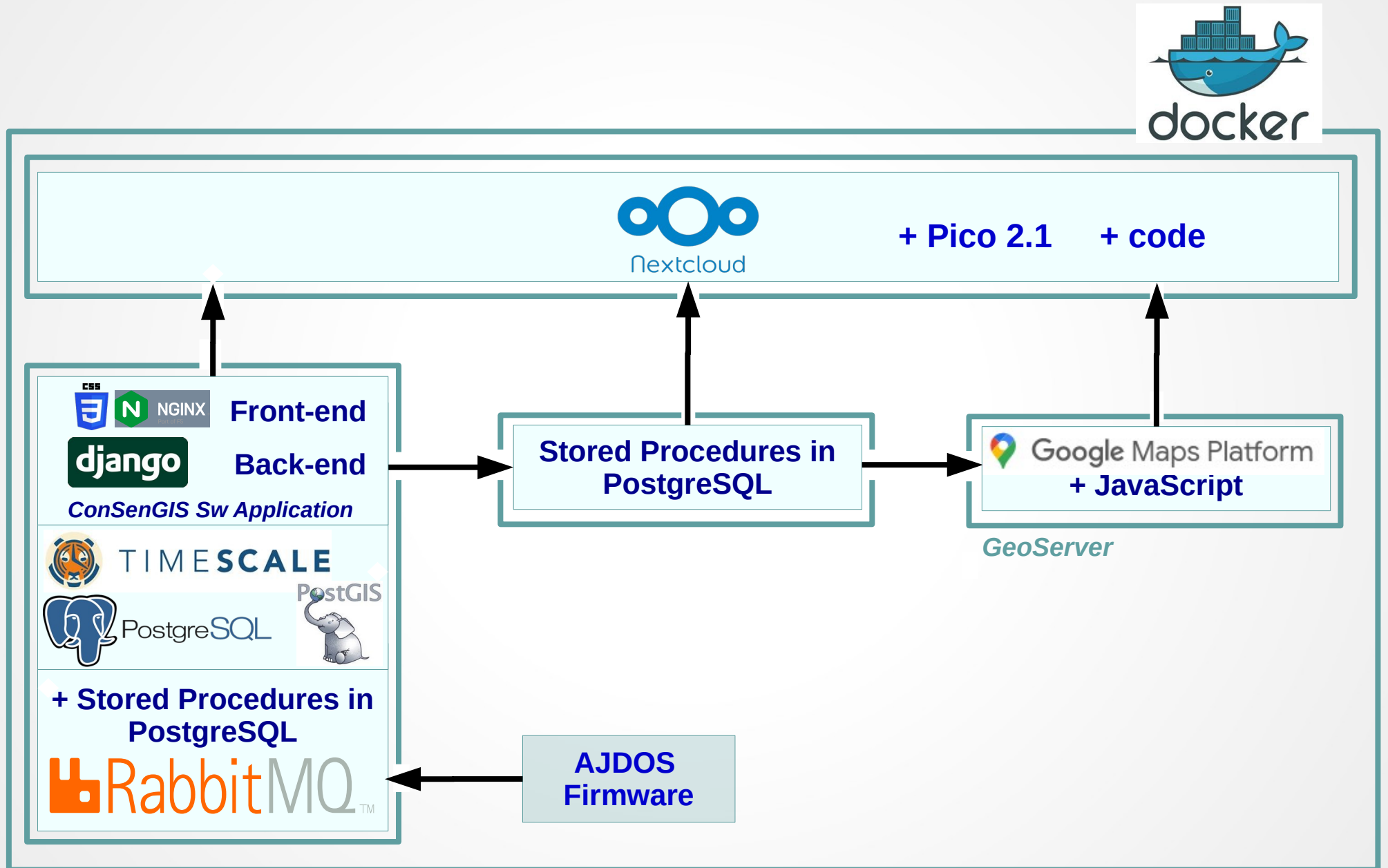
Principles adopted:

- **Simplification** – minimize software coding and use Open Source software technologies;
- **Adaption of Open Standards** – to avoid vendor lock and increase extendibility;
- **Adaption of Mature Technologies** – proven technologies get higher priority;
- **Address security** – the secure solution is a primal design objective;
- **Alternatives** – need to be identified to reduce the risk of abandoning technologies.

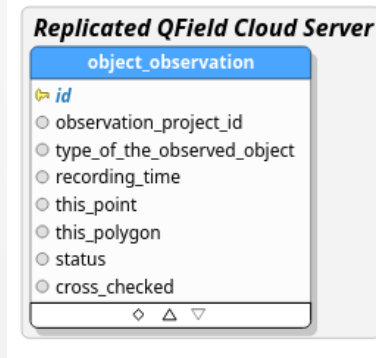
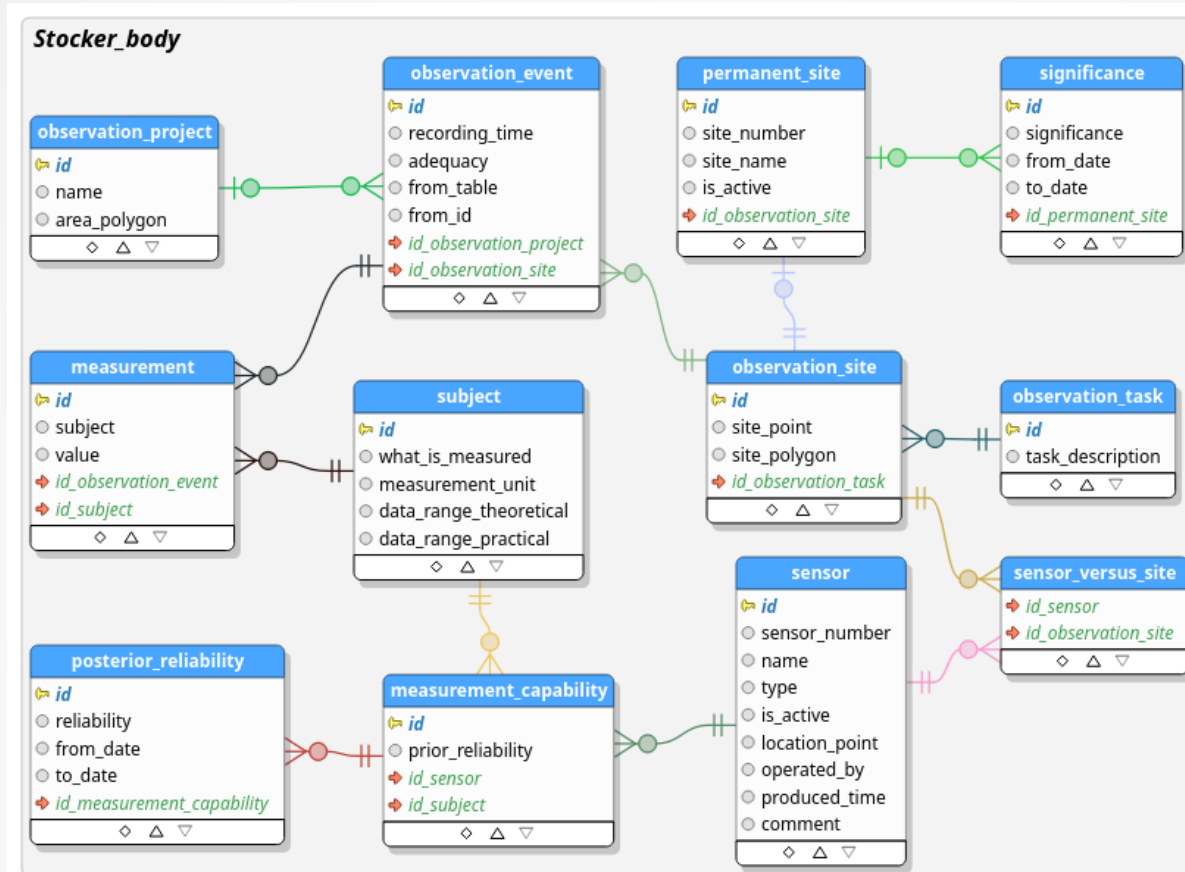
ConSenGIS Platform



Final Software Architecture



ConSenGIS DB Model - Preliminary



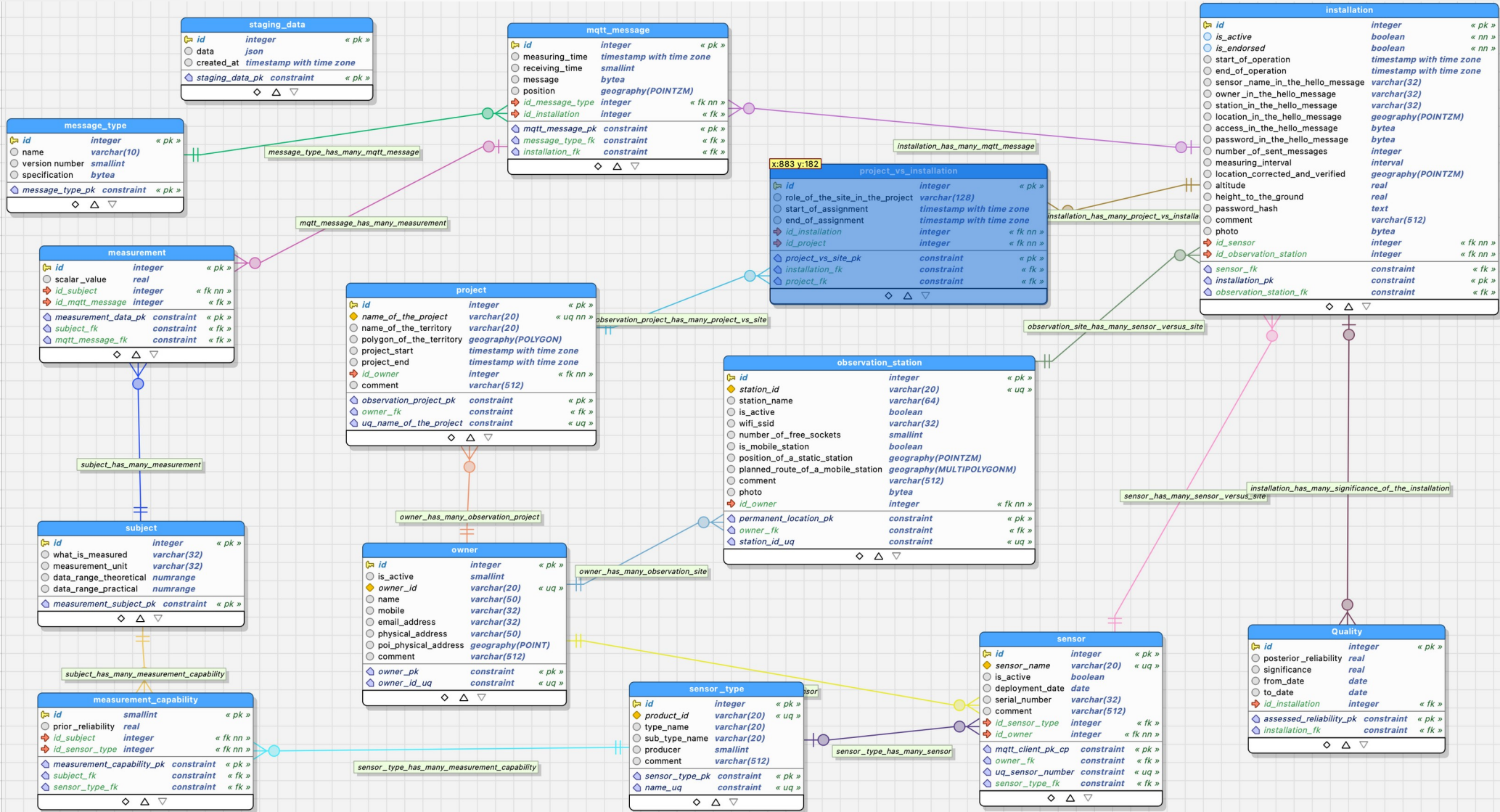
ConSenGIS - Database

All Quality
 Measuring Station
 Design/Measurement

All Quality
 Measuring Station
 Installation

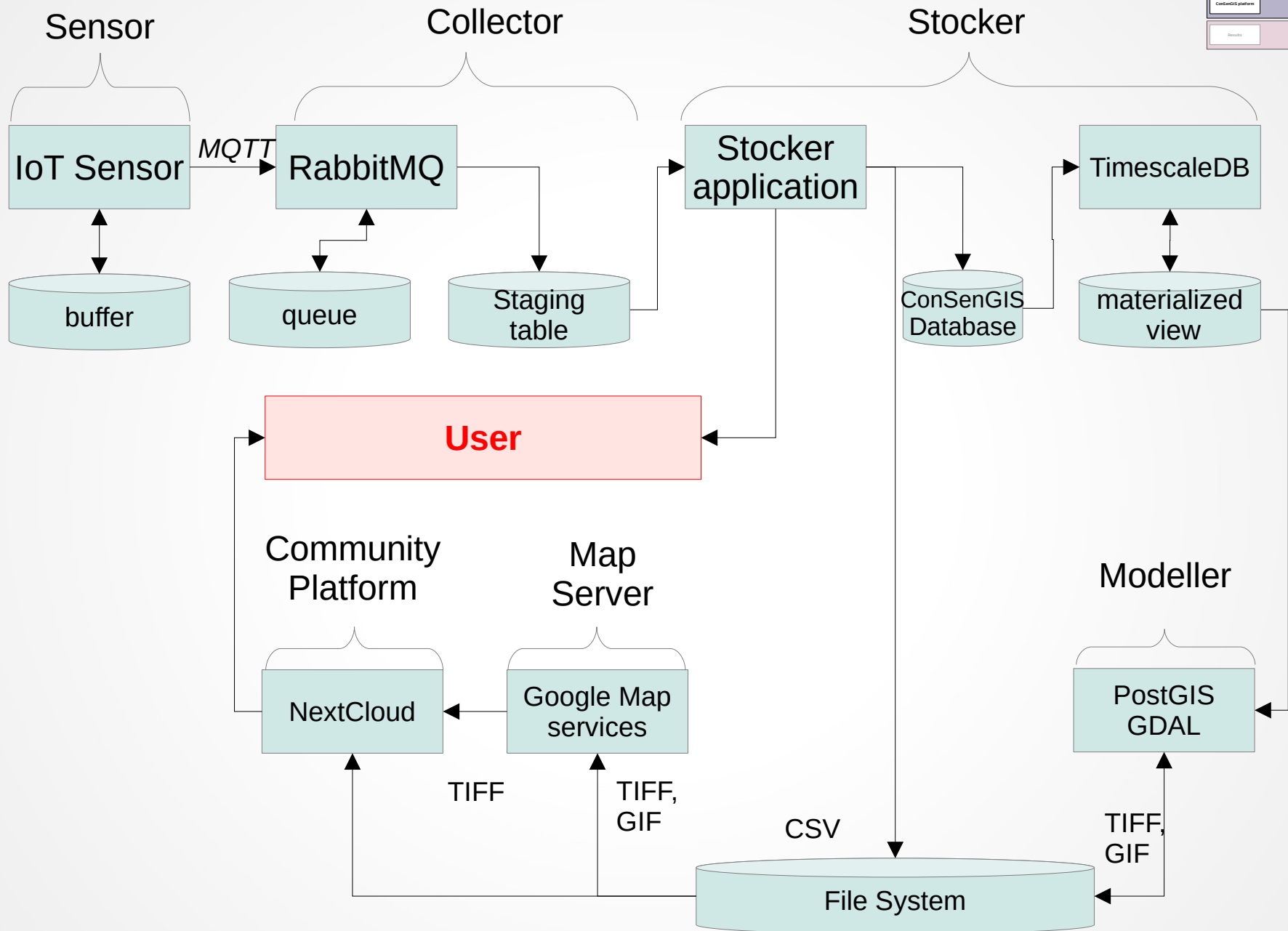
Confirmed platform Architecture & content

Results



Logical Data-flow

Air Quality Monitoring System Design/Implementation
Air Quality Monitoring System Installation
Community platform
Results



ConSenGIS Platform

Air Quality Monitoring System Design/Implementation
Air Quality Monitoring System Installation
ConSenGIS platform
Results
Information on environment

ConSenGIS

Active user is Orsolya , who has owner user role.

This session expires in 00:00:00 time

logout

Welcome

Project

Installation

Station

Sensor

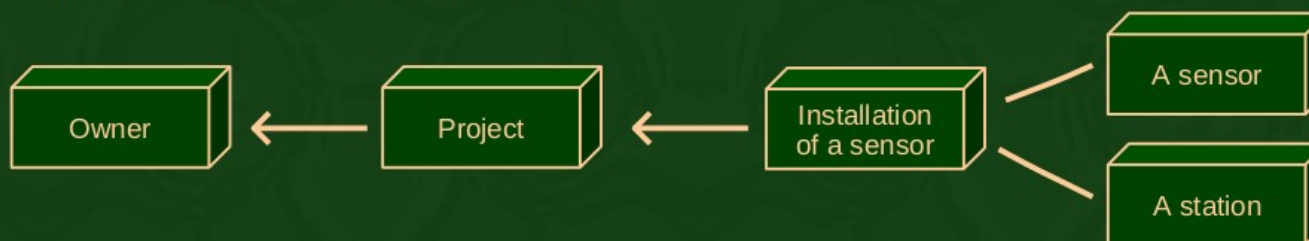
Map

Owner

About

Welcome to the Collector Module of the ConSenGIS System!

Here you can approve new installations of sensors at stations. You can also approve new sensors or stations. You can move/remove installations to/from projects. You can also adjust attributes of these entities, including your data. Moreover locations of entities can be visualized on map.



The Modeler provides an automatic analysis of your data. Your raw data, results of analyses and other interesting data are available via the community platform.

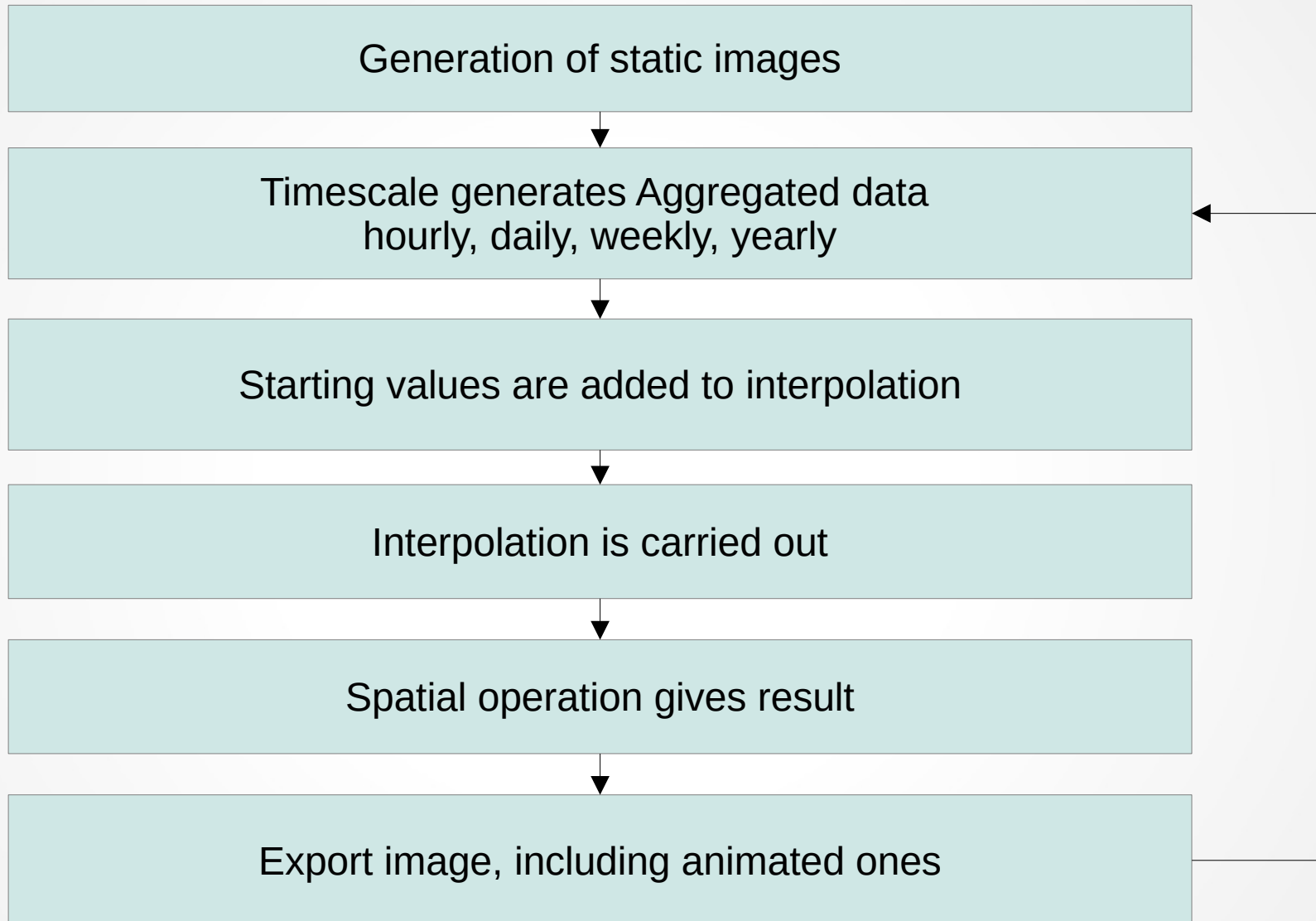
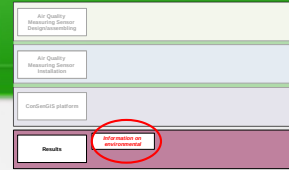
[Go to](#) the Community Platform

ConSenGIS Platform



id	Model id	Layer		Original range		Model value		Weight
		name	image file	from	to	from	to	
pk	fk	Interpolated Measurements PM2.5	../file.tiff	0	200	1	10	9
pk	fk	Interpolated Measurements PM10	../file.tiff	0	100	1	10	9
pk	fk	Temperature	../file.tiff	-20	60	1	20	9
pk	fk	Altitude	../file.tiff	<min>	<max>	1	10	6
pk	fk	Ground height	../file.tiff	0	5	1	10	7
pk	fk	Degree of the slope	../file.tiff	0	90	1	10	7
pk	fk	Direction of the slope	../file.tiff	0	360	1	10	7
pk	fk	Wind direction	../file.tiff	0	360	1	10	5
pk	fk	Wind power	../file.tiff	0	200	1	20	5

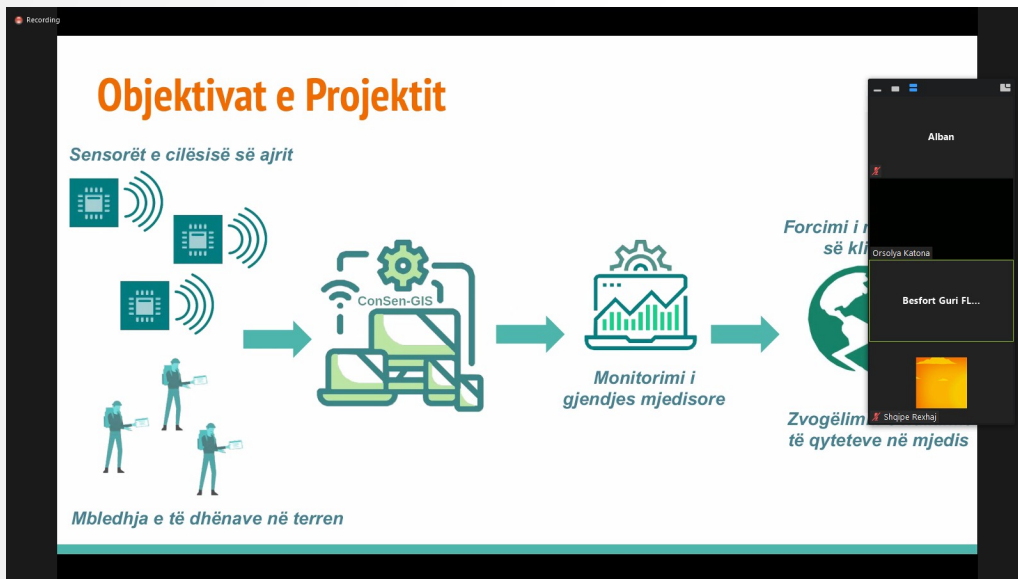
ConSenGIS Platform



Knowledge transfer

Air Quality Monitoring System Design/development
Air Quality Monitoring System Installation
ConSensGIS platform
Results
Knowledge transfer

Municipality of Suhareka
Municipality of Shtime
Municipality of Prizren



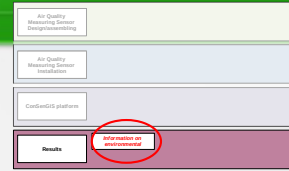
Knowledge transfer

Air Quality Monitoring System Design/development
Air Quality Monitoring System Installation
COVID-19 platform
Results
Knowledge transfer



- **Prizren**
 - Motray Quiriazzi
 - Remzi Ademaj
 - Besim Ndrecaj
 - Deshmoret e Zhurit
- **Shtime**
 - Abdullah Shabeni
 - Emin Duraku
- **Suhareke**
 - Avdyl Ramaj
 - Lidhja e Prizrenit
 - Sadri Duhla
 - Kongresi I Manastirit
 - Edit Durham

Sustainability of GIS-LINK



- **Skills to build sensors and operate the system will be transferred.**
- **Sensors and software platform will be handed over to Open Source Software Society of Kosovo.**
- **This open source software based system can be upgraded without license cost.**
- **Local Communities will be able to continue the operation of the system.**
- **The maintenance of the system is also ensured by the motivation and interest groups of the participants, as they can maintain the health of their own environment and living space, thus donating a more liveable environment to the next generation.**
- **The system is also suitable for future expansion of other information on a voluntary basis, which provides an opportunity to solve intact current problems.**
 - *sensor with SIM card*
 - *Other components: NO₂, NO, O₃, SO₂, CO, etc.*
- **Local Government will be able to use the system provided information for planning and operation their settlements.**

Thank you for your attention

“In order to create a sustainable world, we need to:

- 1) Educate people.
- 2) Educate people.
- 3) Educate people.

For every person left uneducated about the system of this sphere, the nature will make us all pay for it. Sustainability can only start in the mind.”

— A. Togay Koralturk