Prosuming Public Space: the UNPark project

The role of urban infrastructures in the regeneration of the in-between spaces

Paolo Carli
with contributions by Francesco Bruschi, Matteo Clementi, Davide Crippa, Luigi De Nardo, Barbara Di Prete, Carol Monticelli, Giulia Procaccini, Agnese Rebaglio and Patrizia Scrugli

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Prosuming Public Space: the UNPark project illustrates the experience of the Urban Nudging Park research project, funded by the social responsibility program of the Politecnico di Milano through the competitive call Polisocial Award 2019. The book returns the complexity that characterised UNPark: a research by design project, in the wake of tactical urbanism, on the theme of the role that urban infrastructures could have in the regenerative processes of the in-between spaces.

Indeed, UNPark has been a transdisciplinarity effort which took shape through a temporary urban tactical intervention and a study about the possibility of transforming the current parking under the Serra - Monte Ceneri Overpass, in Milan, into a multifunctional space equipped for social activities, including street sports.

Prosuming Public Space: the UNPark project is a monographic book, with thematic chapters by the members of the work team, that proposes, in addition to recalling the research work phases, reflections on the city during the pandemic, on the co-design, on the multifunctional regeneration of the urban infrastructures, and about the needed transdisciplinarity in any urban design intervention.

Publishing Series POLITECNICA

ISBN 978-88-916-5582-0

DOI: 10.30448/UNI.916.55820
https://doi.org/10.30448/UNI.916.55820

Published by Maggioli Editore February 2023
Copertina: Asia Gallorini
Progetto grafico e impaginazione: Asia Gallorini

Maggioli Editore is part of Maggioli S.p.A
ISO 9001 : 2015 Certified Company
47822 Santarcangelo di Romagna (RN) • Via del Carpino, 8
Tel. 0541/628111 • Fax 0541/622595
www.maggiolieditore.it
e-mail: clienti.editore@maggioli.it

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Designing the future as social responsibility

Massimo Bricocoli

Head of the Department of Architecture and Urban Studies (DAStU) and Full Professor of Urban Planning, Politecnico di Milano

Social responsibility has become a mainstream word and reference, a label that remarks the possible engagement of all sorts of organizations, also private, in delivering outcomes that may be valued as socially relevant. To which extent can this be a challenge for Academic institutions? To which extent scholars and researchers may make even more explicit the societal value of the outcomes of their investigations and experimentations?

Politecnico di Milano is a leading university in the field of Engineering, Architecture and Design, with a solid tradition in a multidisciplinary approach, developing fruitful relationships with business and productive world by means of experimental research and technological transfer. In the latter years, the issue of "transfer" has been extensively explored and developed, with specific attention to the urban and regional context and to contributing – through the transfer of research outcomes and applied research – to supporting innovative and frontline projects at different levels and in different domains. Integrated and reality-based projects are increasingly a relevant front of work at Politecnico di Milano being the case of research developed with industrial partners or of local projects developed in an urban context like the one

VII. Mapping opportunities and criticalities, open geo data as tools to support analysis, public engagement and design

Matteo Clementi and Francesco Bruschi

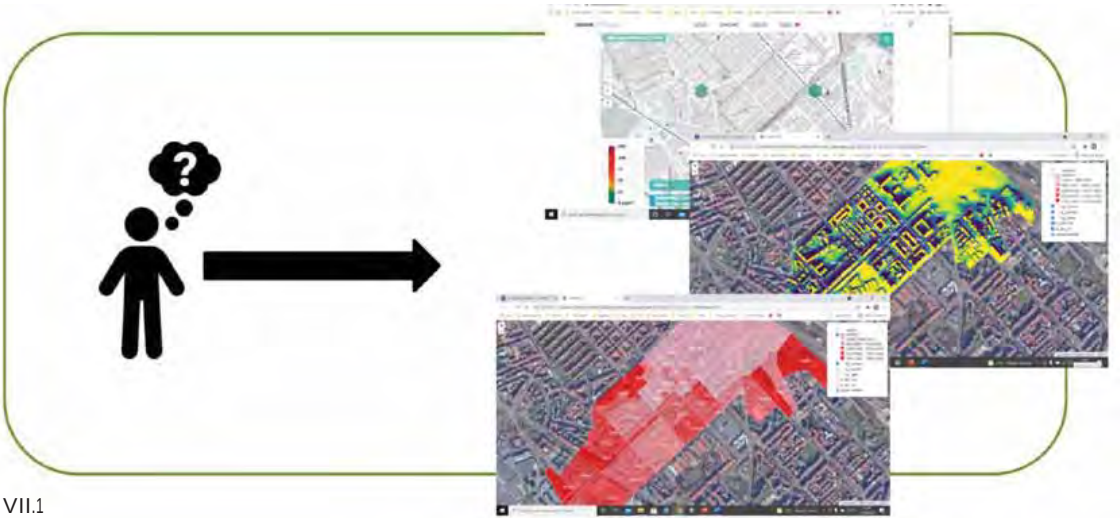
The thematic chapter illustrates the open-source tools and procedures used in the analysis and mapping of the main environmental variables, with the intention of making information available to local actors to support possible procedures for activating the public space. The choice to use open-source tools and data was motivated by the intention to enable communities to implement data and make the environmental survey experience of the UNPark project easily replicable. The mapped data is organized around two macro areas, that of criticalities and that of opportunities. The first includes the retrieval and mapping of information relating to air quality and noise. The second macro area, that of opportunities, presents specific themes starting from the main strategies involved in the development of scenarios oriented to sustainable and circular urban metabolism, namely: use of energy and local resources, reuse, and recycling (Rueda, 2012; Hebel et al., 2014).

VII.1. OPEN TOOLS AND OPEN DATA TO SUPPORT A PROSUMING COMMUNITY

What we have been working on is a method that starts from the information normally made available to citizens to create support tools for decisions that can be managed from below. Therefore, to ensure the replicability of the procedure to a wide audience the research relies exclusively on open data provided by governmental and institutions or self-produced data. The open-access data used for the development of the present work are:

1. The Topographic Database (DBT) of the local municipality, providing topographic information on the local built environment, including building heights and shapes and typology of open-space surfaces (https://geoportale.comune.milano.it/sit/open-data/). Comparable databases are available for most of the Italian regions and are developed with the same national guidelines.
2. Data on local population and buildings associated with census sections (ISTAT, 2012).
3. Data from the regional urban waste observatory (https://orso.arpalombardia.it/).
4. Air quality data provided by ARPA survey station (https://www.arpalombardia.it/).
5. Self-produced air quality data.
6. Climatic data relating to the municipality of Milan (UNI, 2016).
7. Self-measured data on the level of noise pollution.

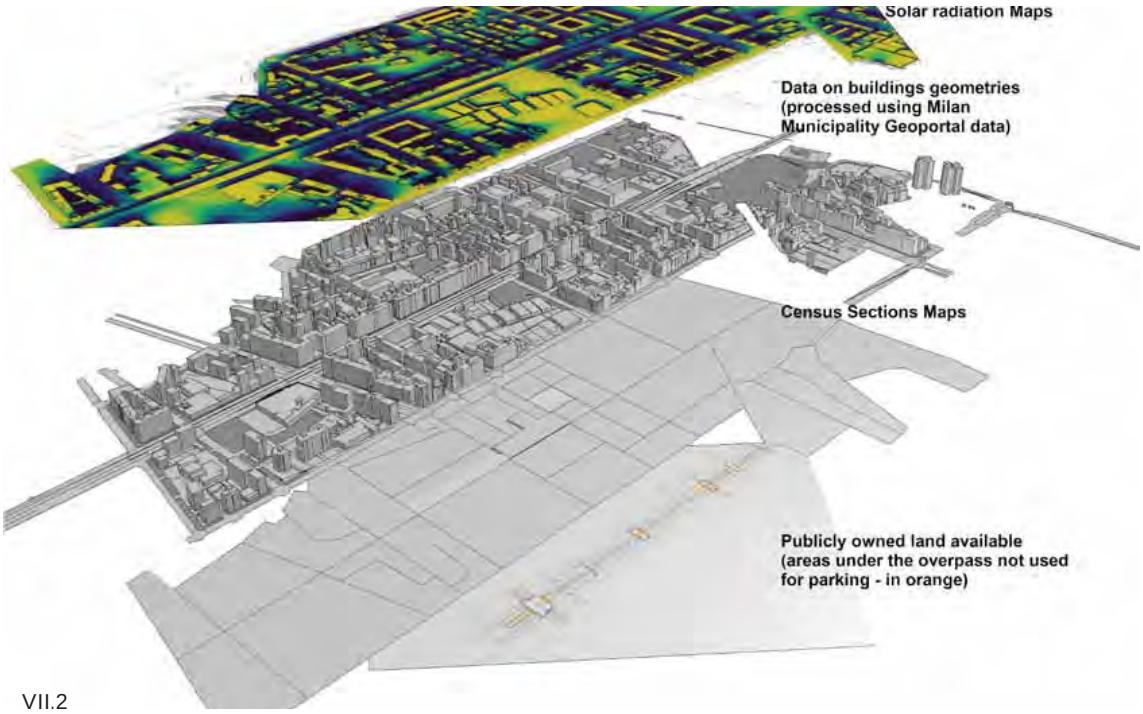
This information has been used to develop specific themes that collect information on local criticalities and opportunities on the same geographic information system (GIS) to support local actors design decisions. In particular, regarding local criticalities, particular attention was paid to the problem of air



VII.1

FIGURE VII.1 - Some of the themes mapped in the environmental survey phase, 2021 (Source: UNPark/Matteo Clementi)

pollution and noise pollution. As for the opportunities, the information was organized around 4 macro areas relating specifically to materials, energy, unused spaces, and the available workforce present. As regards the local flows of potentially usable materials, reference was made to what is made available by the local urban metabolism, to solid urban waste, and to the waste made available by specific facilities linked to the specificities of the local environment, such as polymeric fabrics from street advertising. Regarding the survey on available and unused local energy, the focus was on the availability of solar energy, for manpower availability and the public spaces availability, please refer to the specific in-depth following paragraphs. In the macro area of criticalities, the survey of data relating to air quality was conducted through activities of direct involvement of the local community. To this end, UNPark joined the worldwide open-data Sensor-Community network (https://sensor.community/it/) directly involving some local associations and schools in self-monitoring initiatives. During the project, this experience included the activation of four low-cost units for detecting particulate matter



VII.2

Figure VII.2 - Main information layers that make up the georeferenced database under development, 2021 (Source: UNPark/Matteo Clementi)

(PM10 and PM2.5) in the area affected by the flyover, three control units in close proximity to Serra - Monte Ceneri overpass and one in the Rinnovata Pizzigoni school building.

VII.2 CRITICAL ISSUES

VII.2.1 Air quality

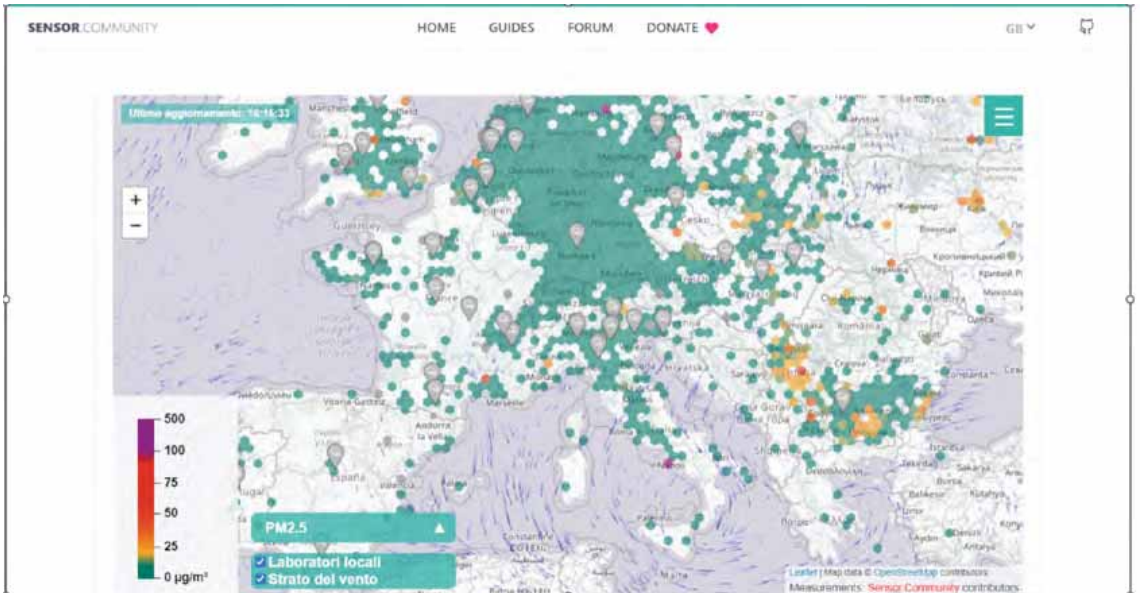
ARPA Lombardia monitors air quality using control units in urban areas, but the resolution level is not adequate to understand the particular situation of Viale Monte Ceneri. The question that has been asked is therefore the following: Is it possible to integrate the current very reliable but point-like environmental monitoring network with a more widespread low-cost system manageable by the local community, with the aim of increasing the resolution level of the detected

data? With the term “increase the resolution of the data at a spatial level”, we intend to understand how much, compared to the value recorded by the nearest ARPA control unit in viale Marche, the local value increases or decreases in the spaces in the immediate vicinity of the overpass and to understand how much this criticality can be harmful for the users of the public space, pedestrians and cyclists but also for the inhabitants who live near the structure. About the temporal attribute, it is intended to monitor the variation of emissions in the different days of the year and at different times of the day in order to understand if there are intervals in which the values are adequate for carrying out specific activities. Currently the technology is mature to provide the established community at an affordable cost with adequate monitoring systems, as demonstrated by the Sensor.Community network (SC), constantly updated on the website www.sensor.community, which counts the presence of low-cost sensors throughout the world. It is an open technology in both hardware and software. In the UNPark project, this technology was used to develop two types of low-cost detection devices, one fixed connected to a local wifi network and one mobile connected directly to a mobile phone.

- Fixed survey unit

As mentioned above, about fixed detection units, UNPark by joining the SC network has relied on the indications provided by the network for the self-construction of a type of fixed detection unit capable of monitoring the characteristics of the particle pollution (PM10 and PM2,5), air temperature and relative humidity. As for the hardware, SC employs sensors that can be used with the help of small controllers like Arduino (Esp8266) capable of reading an open programming language and consequently rich in free scripts

available to everyone. As far as software is concerned, the SC network provides open-source software, i.e. free access, open and implementable, both for the configuration of the detection units and for the publication of data. In the first case it is sufficient to load it into the control unit through your PC and a sw developed by the network and downloadable for free from the web site.
In the second, it provides its own web space and its own interactive maps to consult the data, the data collected in real time can in fact be consulted on the website https://sensor.community/it/.
This platform allows to publish the data and view them together with the output of other detection units, increasing the resolution level of the information based on the number of control units, laying the foundations for achieving an adequate level of spatial resolution.
Going into more detail on the procedure adopted to start up a local network monitored from below, it is necessary to mention that the UNPark project followed the procedures made available online, relying on two sources of reference, the sensor.community website and the website of the Italian association Centralinedalbasso, http://centralinedalbasso.org/.
The sensor.community website gives specific indications also in Italian on where to find the parts, where to download the software and the drivers of the detection unit, however it refers to slightly more complicated operations relating to humidity and temperature sensors, providing for welding operations that not all are capable of carrying out. The Centralinedalbasso association, having been the first in Italy to join the SC network, has published on its website the assembly procedure relating to a simpler control unit which is part of the SC proposals, but which does not necessarily require to proceed with tin soldering. This information available online allowed to start the experimentation, buying the sensors, the



VII.3

FIGURE VII.3 – A screenshot from sensor.community interactive maps, 2021 (Source: https://sensor.community/it/)

controllers (the small 4 euro computers that manage the sensors and transmit data via wifi) and test the sw to set the control unit and publish the data. The only problem that remained to be solved was how to work on something that was waterproof and did not attract too much attention, another requirement was to be able to anchor it easily and in a reversible manner. We therefore opted for maximum economy and anonymity, placing the electronic devices in a junction box for outdoor electrical systems. The system is very flexible, the equipment that can be purchased in any electrical retailer or DIY supermarket provide acceptable result and completely camouflaged in the elements that we often see on the poles of our cities and on the facades at the street level of the urban environment. The box also lends itself to being installed on different supports using easily reversible anchoring systems through perforated metal plates screwed to the back, used to anchor the box to various types of supports with plastic clamps. (for example, roller blind tracks, shutters).


VII.4(1)

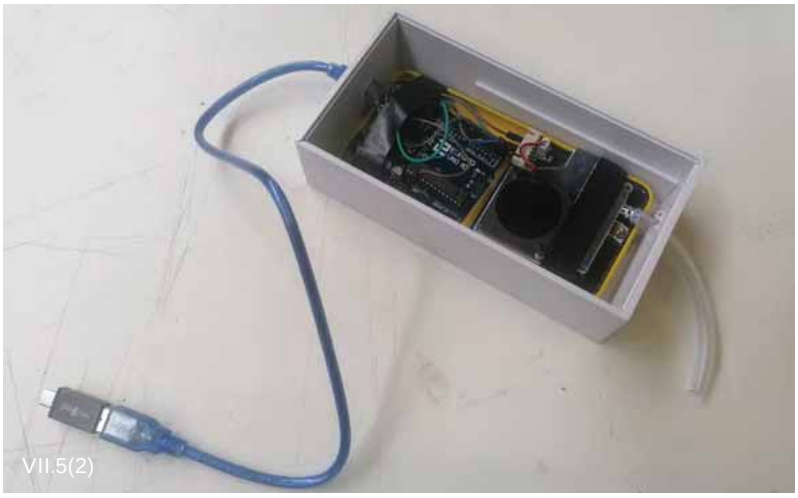

VII.4(2)

FIGURE VII.4(1)(2) - Images of one of the fixed detection units installed near the Serra - Monte Ceneri Overpass, 2021 (Source: UNPark/Matteo Clementi)

- Mobile survey unit

The mobile detection unit does not rely on a shared monitoring infrastructure but supports the direct reading of data from a mobile phone. In this case, the same particulate sensor used in the fixed units was connected to an Arduino controller and powered directly via a mobile phone. The connection to a mobile phone allowed to power the electronic devices and to be able to read the data using free apps for monitoring the data detected by Arduino (in our case the Serialmonitor app).

VII.5(1)



VII.5(2)

VII.5(3)

FIGURE VII.5 (1)(2)(3)- Some images of the mobile survey unit for particulate detection (PM10, PM 2,5), 2021 (Source: UNPark/ Matteo Clementi)

- Data collected

At the end of the work, the auto-detection network had a total of four fixed and one mobile control units. As for the fixed control units, the network consists of various stations located near the overpass and identifiable on the SC website with a unique code:

- Esp8266-9546419 on the fifth floor of viale Monte Ceneri, located on a balcony overlooking the avenue (operational from July 2021 to June 2022).
- Esp8266-11516636 on a window on the street level of the arci club, via Bodoni 2, (operational from July to November 2021, from March to May 2022)
- Esp8266-11466803 on the ground floor of via Pietro di Cemmo n.2, particulate sensor 63488, temperature and humidity sensor 63489 (operational from July to December 2021)
- Esp8266-12700892 installed later in a classroom of the Dante Alighieri school, in via Mac Mahon 100, (from January to June 2022)

The mobile unit has been used to compare the data recorded under the overpass with those detected by

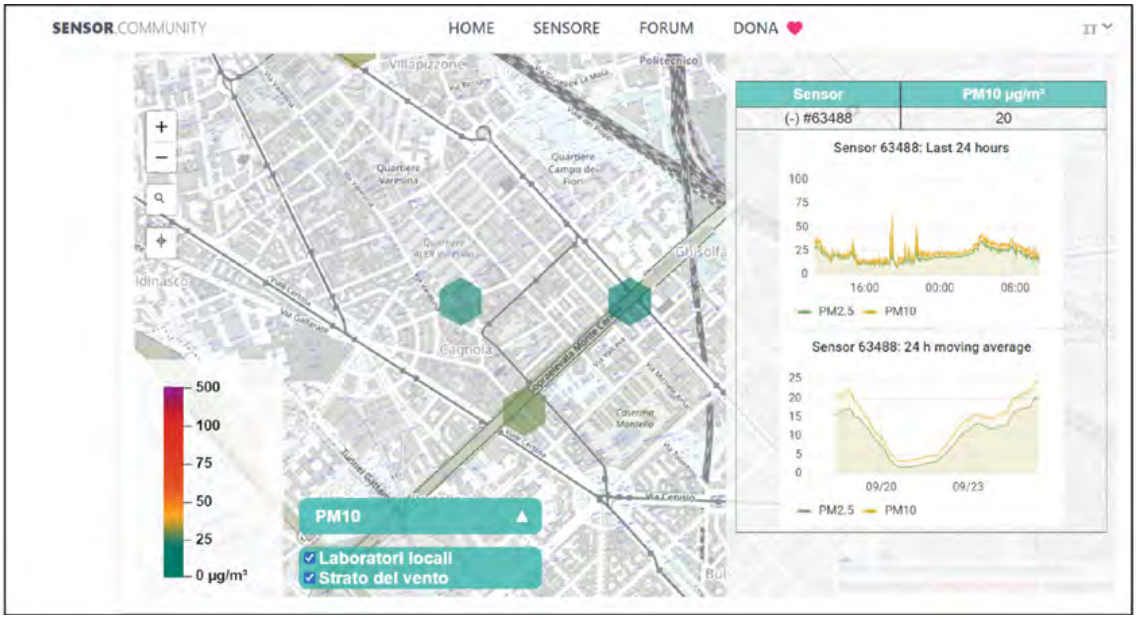
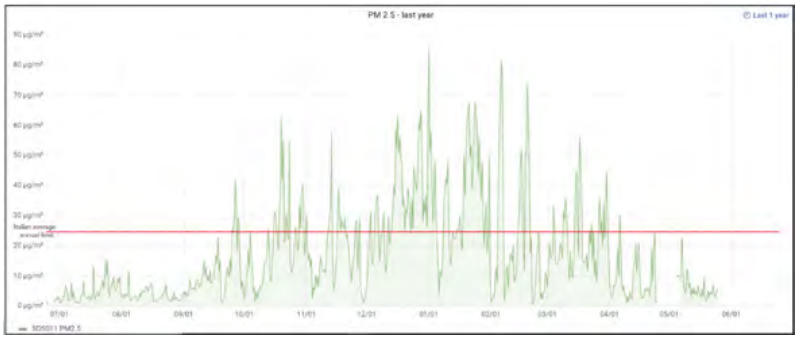


FIGURE VII.6 - Map of the three outdoor fixed stations located near the Serra - Monte Ceneri Overpass, 2022 (Source: https://sensor.community/it/)

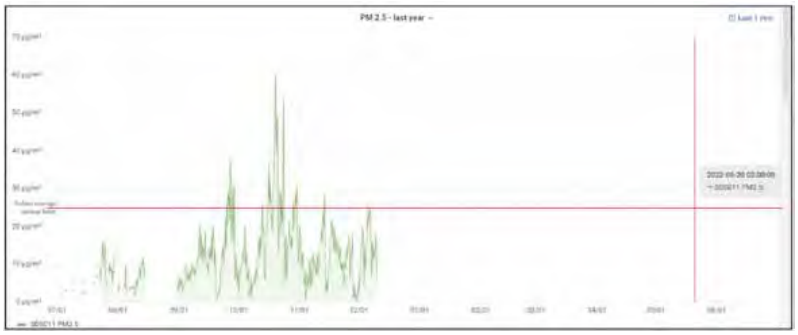
VII.6

the fixed positions. The data collected by the fixed control units can be consulted using the identification code (Esp...) at the following web address: https://api-r-rd.madavi.de/grafana/d/GUaL5aZMz/pm-sensors?orgId=1&theme=light&var-chipID=
The following graphs illustrate the quantities detected by the fixed units in the respective operating periods.



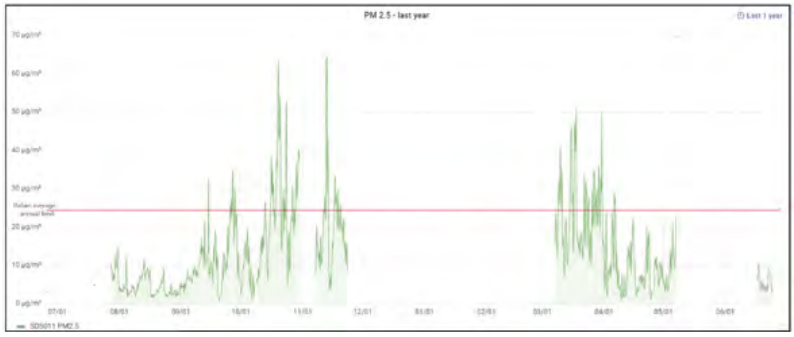
VII.7

FIGURE VII.7 - Graph of the data collected in viale Monte Ceneri, from July 2021 to June 2022 (PM2.5), 2022 (Source: UNPark and https://sensor.community/it/)



VII.8

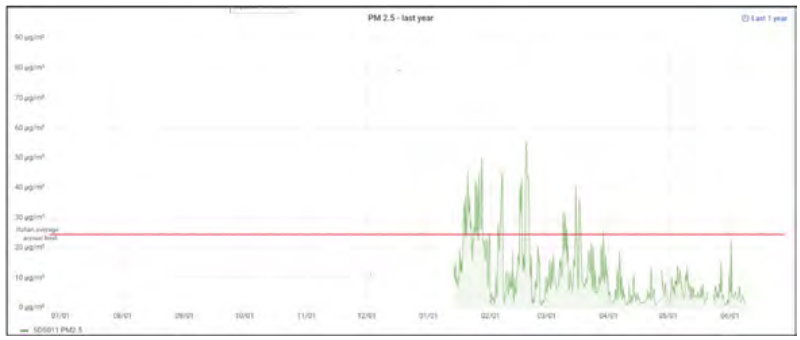
FIGURE VII.8 - Graph of the data collected in via Pietro di Cemmo, from July 2021 to June 2022 (PM2.5), 2022 (Source: UNPark and https://sensor.community/it/)



VII.9

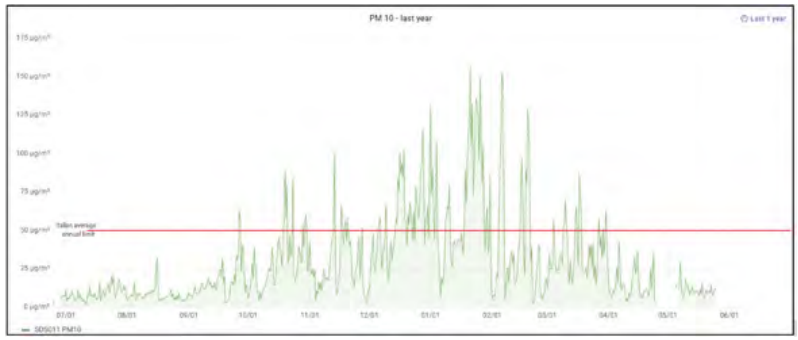
FIGURE VII.9 - Graph of the data collected in via Bodoni, from July 2021 to June 2022 (PM2.5), 2022 (Source: UNPark and https://sensor.community/it/)

FIGURE VII.10 - Graph of the data collected in a classroom in the school in via Mac Mahon, from July 2021 to June 2022 (PM2.5), 2021 (Source: UNPark and https://sensor.community/it/)



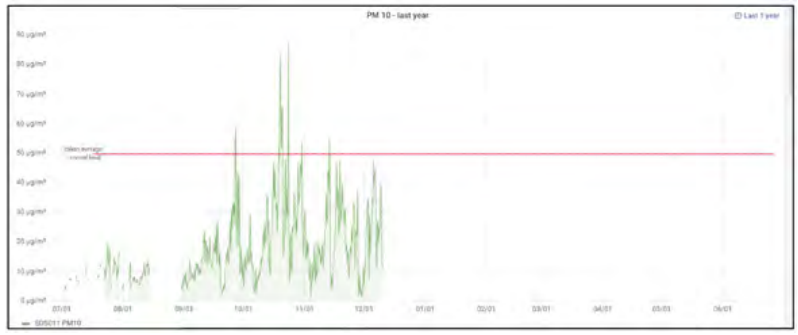
VII.10

FIGURE VII.11 - Graph of the data collected in a classroom in viale Monte Ceneri, from July 2021 to June 2022 (PM10), 2022 (Source: UNPark and https://sensor.community/it/)



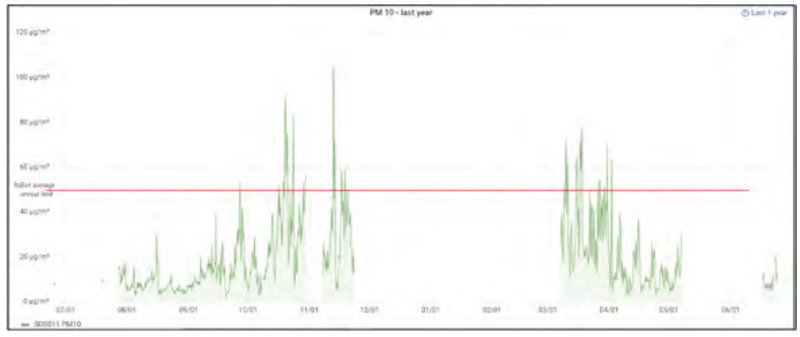
VII.11

FIGURE VII.12 - Graph of the data collected in via Pietro di Cemmo, from July 2021 to June 2022 (PM10), 2022 (Source: UNPark and https://sensor.community/it/)

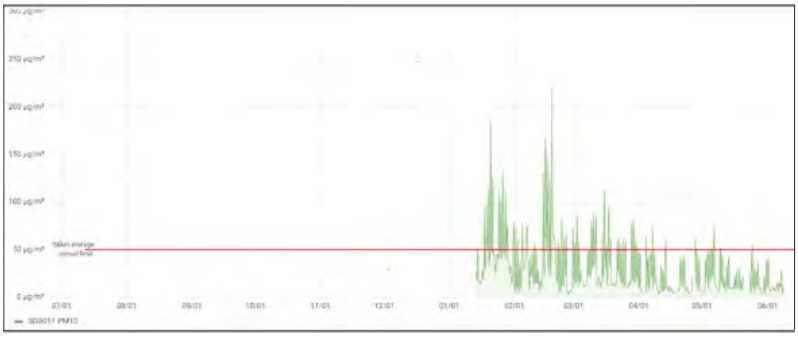


VII.12

FIGURE VII.13 - Graph of the data collected in via Bodoni, from July 2021 to June 2022 (PM10), 2022 (Source: UNPark and https://sensor.community/it/)



VII.13



VII.14

FIGURE VII.14 - Graph of the data detected by the control unit located in a classroom in the school in via Mac Mahon, from July 2021 to June 2022 (PM10), 2022 (Source: UNPark and https://sensor.community/it/)

Instead, the following graphs are related to what was detected in two days of September 2021, this information has a dual purpose: to illustrate the variability of the time of the concentration of particulate matter during a day and to compare the difference of the data detected in the different portions of the fabric where the detection units are located.

VII.15

FIGURE VII.15 - Data collected in the control unit in viale Monte Ceneri, 16 and 17 September 2021 (PM 2.5), 2022 (Source: UNPark and https://sensor.community/it/)

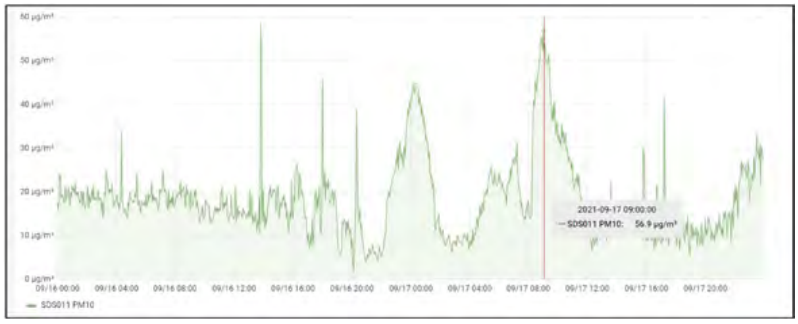
VII.16

FIGURE VII.16 - Data collected in the control unit in via Pietro di Cemmo, 16 and 17 September 2021 (PM 2.5), 2022 (Source: UNPark and https://sensor.community/it/)

FIGURE VII.17 - Data collected in the control unit in viale Monte Ceneri, 16 and 17 September 2021 (PM10), 2022 (Source: UNPark and https://sensor.community/it/)

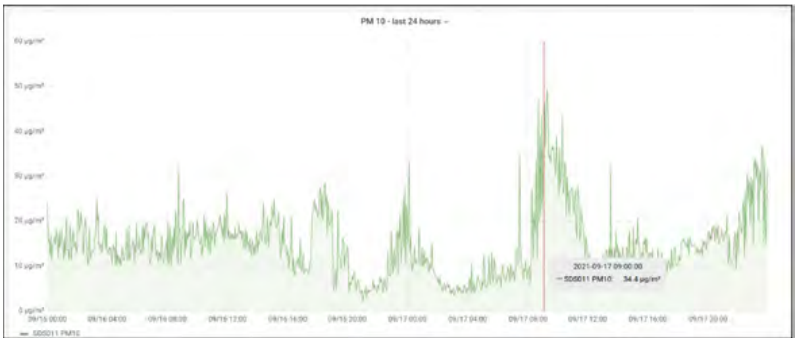
VII.17

FIGURE VII.18 - PM 10 data detected in the control unit in via Pietro di Cemmo, 16 and 17 September 2021 (PM10), 2022 (Source: UNPark and https://sensor.community/it/)



VII.18

FIGURE VII.19 - PM 10 data detected in the control unit in via Bodoni, 16 and 17 September 2021 (PM10), 2022 (Source: UNPark and https://sensor.community/it/)



VII.19

To understand the variability of the quantities detected depending on the position (distance from the overpass), the data collected on a September day, in particular on 17 September 2021, have been analyzed and compared (See Fig. VII.20).

As regards the presence of PM10, the Italian low imposes a limit equal to 50 micrograms / meter not to be exceeded for more than 35 days and an average

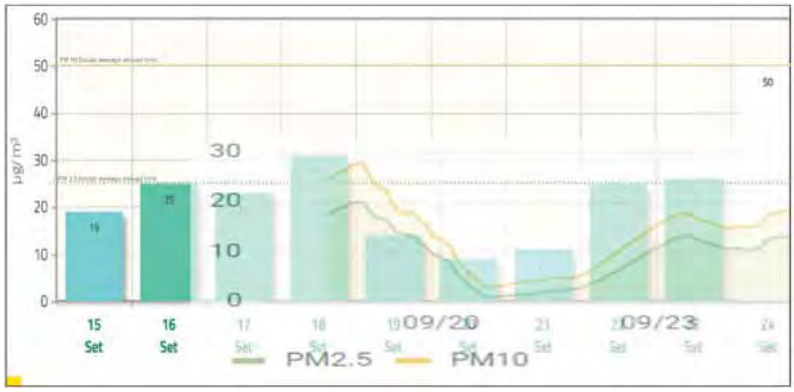
September 17th 2021	viale Monte Ceneri under		Viale Monte Ceneri 6th floor		via Pietro da Cemmo Ground level		via Bodoni First Floor	
daytime	pm2,5	pm10	pm2,5	pm10	pm2,5	pm10	pm2,5	pm10
08 45	43,3	74,3	42,1	68,9	32,2	50,3	14,8	20
09 11	60,1	122,6	38,6	62,9	29,7	49,8	24,1	40,4
09 27	40,7	80,7	32,4	52,3	27,5	43,7	21,8	34,7
09 31	51,1	90,4	31,6	49,5	25	41,4	22,3	35,7
12 18	9,6	14,6	5,6	7,18	5,3	6,53	5,96	8,63

VII.20

FIGURE VII.20 - Comparison between the data detected by the control unit under the overpass (viale Monteceneri under) and the fixed outdoor detection positions, 2022 (Source: UNPark/Matteo Clementi)

annual limit of 40 micrograms / meter. As regards the presence of PM2.5, the average annual limit is equal to 25 micrograms / meter.

The information that emerged during the monitoring campaign denounces a very high concentration of particulate matter during the winter period in the months of January, February and March and in particular hours of the day with peaks relating to the early part of the morning and late afternoon on the occasion of entry and exit from the workplace. As evidenced by the graphs that investigate the September trend, peaks are also recorded in the night period on Friday and Saturday when people use to move towards weekend evening recreation destinations. The detection in a confined environment (one classroom) shows a similar daily trend, with particular peaks detected probably due to the lack of air exchange. Those data, being the result of surveys car



VII.21

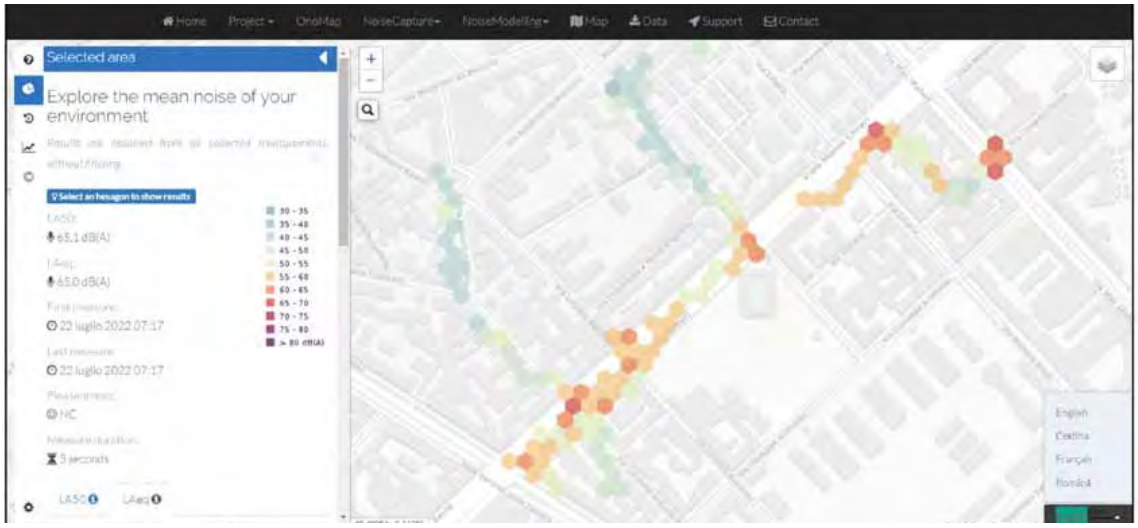
FIGURE VII.21 - Comparison between the data detected by a sensor.community network control unit nearby and Arpa data near the control unit in viale Marche, 2022 (Source: UNPark and https://sensor.community/it/)

ried out with low-cost sensors, require future insight through a comparison with what detected by ARPA and the certification of the data by the same public body. The graph in the Figure VII.21 presents a comparison between what was detected by the ARPA detection unit in viale Marche and the closest low-cost control unit in the SC database.
As detected in a confined environment, the data presented in the graphs refer to a shorter time frame than the entire detection interval, the reader can refer to the SC website for consultation of what has been found to date.

VII.2.2 Noise pollution

As for the critical issues relating to noise pollution, the work focused on the recognition of possible apps that would allow the use of a mobile phone as an acoustic detection tool. The research identified useful support tools in the citizen science project "Noise-Planet Scientific - tools for environmental noise assessment", developed and promoted by the CNRS, the French national scientific research center in collaboration with the UMRAE laboratory *https://*

FIGURE VII.22 - Map of noise pollution data detected in Viale Monte Ceneri, screenshot from the noise planet data storage site, 2022 (Source: https://noise-planet.org/map.html)



VII.22

www.umrae.fr/ of the Gustave Eiffel University of Paris. Among the tools developed by the project is the "Noise capture" app (https://noise-planet.org/noise-capture.html). This app allows to use a mobile phone to detect noise pollution conditions and allows to map the findings by archiving them in a shared georeferenced database (https://noise-planet.org/map.html). What has been noted as an example clearly highlights the differentiated conditions of noise pollution between the area of Viale Serra - Monte Cenere and the blocks nearby, with variations in intensity that exceed 80 decibels near the overpass up to 30 decibels of some internal roads.

VII.3 OPPORTUNITIES

VII.3.1 Local MSW generation: mapping material outflows

The mapping of outgoing material flows was carried out by associating the per capita flows detected by the regional waste observatory with the number of residents in the census section (data referring to the province of Milan in 2019) (https://orso.arpalombardia.it/). The yearly estimated and associable outgoing household waste material flows for the area in exam are shown in the following Fig. VII.23.
By multiplying the quantities of waste generated with the number of residents provided by ISTAT, the total amount of MSW generated within the area can be obtained (Fig. VII.24).

FIGURE VII.23 - Yearly outgoing household waste material flows by category in Milan province, 2019 (Source: UNPark/Matteo Clementi).

Waste type	Quantity kg/person*y	Density kg/m^3	Volume m^3/person*y
Organic waste	70.7	600	0.118
Polymers	20.7	950	0.022
Paper	51.9	970	0.054
Glass	40.7	2500	0.016
Metals	5.77	2700	0.0021

VII.23

VII.24

FIGURE VII.24 - Census sections of the case study labeled with the household waste material flows (kg of paper/year), 2019 (Source: UNPark/ Matteo Clementi)

VII.3.2 Road advertising

The UNPark project, in addition to the outflows from the housing sectors in the form of solid urban, polymeric, organic and paper waste, has identified other waste streams emitted locally that could have interesting potential for use.

These are the PVC fabrics used for road advertising. In fact, in the vicinity of the overpass there are various support structures for such large advertising devices, which are periodically dismantled at weekly or monthly intervals.
This activity gives rise to continuous flows of light material with high mechanical performance and large dimensions, potentially usable for zero-cost setups in the spaces below the overpass.

VII.3.3 Unused energy: Mapping unused renewable energy potential

The overpass in certain areas represents a huge solar collector capable of supplying a considerable amount of electricity for mobility, the upper part of the overpass, could become an important renewable energy source in the neighborhood.
According to the various land use destinations that characterize the local area of reference, this phase of the methodology aims to assess and map the type and amount of renewable energy available (Clementi, 2019). In this case, being a densely urbanized area, the research project maps the solar renewable energy potential. The topographic database available for the municipality of Milan associates the eaves height to the buildings polygons. That information, together with the street level contour lines, allows for generating high-resolution digital elevation models (DEM - 1 pixel / 50 cm) useful for mapping solar radiation incident on open spaces and roofs using open-sour

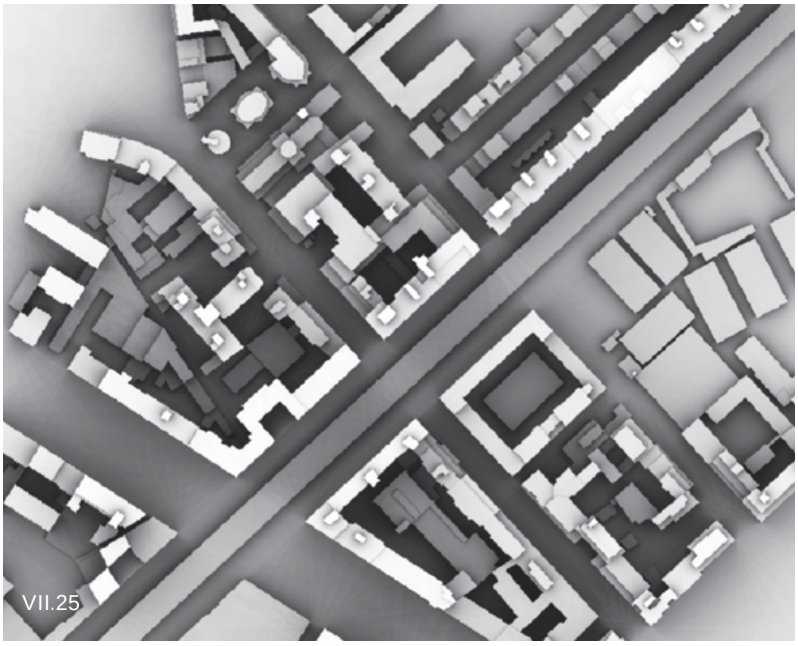


FIGURE VII.25 - Sky view factor, expressed as a percentage, 2022 (Source: UNPark/Matteo Clementi)

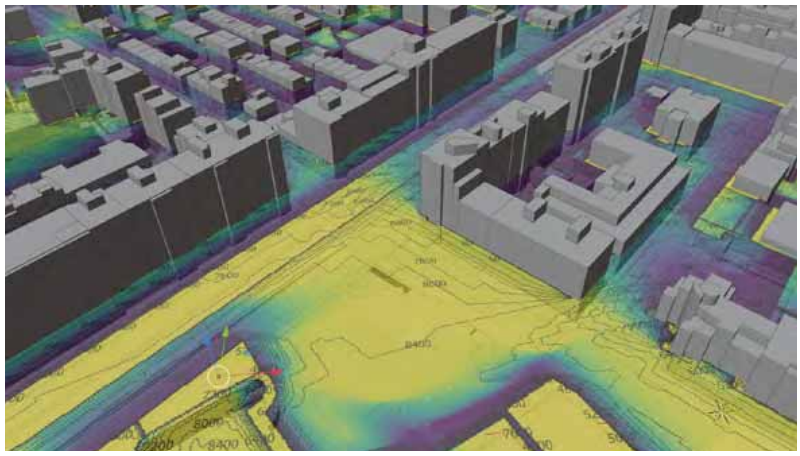
FIGURE VII.26 - June Daily solar irradiation clear sky, 2021 (Source: UNPark/Matteo Clementi)

VII.26

FIGURE VII.27 - December Daily solar radiation clear sky, 2021 (Source: UNPark/Matteo Clementi)

VII.27

*FIGURE VII.28 - 3D model of a portion of urban fabric nearby the Serra - Monte Ceneri overpass, processed using the data published on the geoportal of the Milan municipality with the addition of the solar radiation map presented in Figure VII.3, the numerical values refer to Wh/m2*day, (Source: UNPark/Matteo Clementi)*



VII.28

ce GIS, thanks to tools such as the one proposed by Hofierka (Hofierka, 2002). If accompanied by isopleths (Fig. VII.28), these maps can be consulted using common web services such as Google Earth, allowing easy access to information, even for those who do not use GIS software. In the specific case of this study, these maps have the purpose of showing and measuring the potential solar energy available on the overpass and on the roofs and open spaces nearby.

VII.3.4 Space availability

Under the flyover there are currently some unused areas that can be transformed into spaces available to the community. The current hypothesis considers publicly owned land as open spaces available, such as the areas under the overpass not used for parking.

FIGURE VII.29 - Publicly owned land, such as the areas under the overpass not used for parking (in orange), 2021 (Source: UNPark/Matteo Clementi)

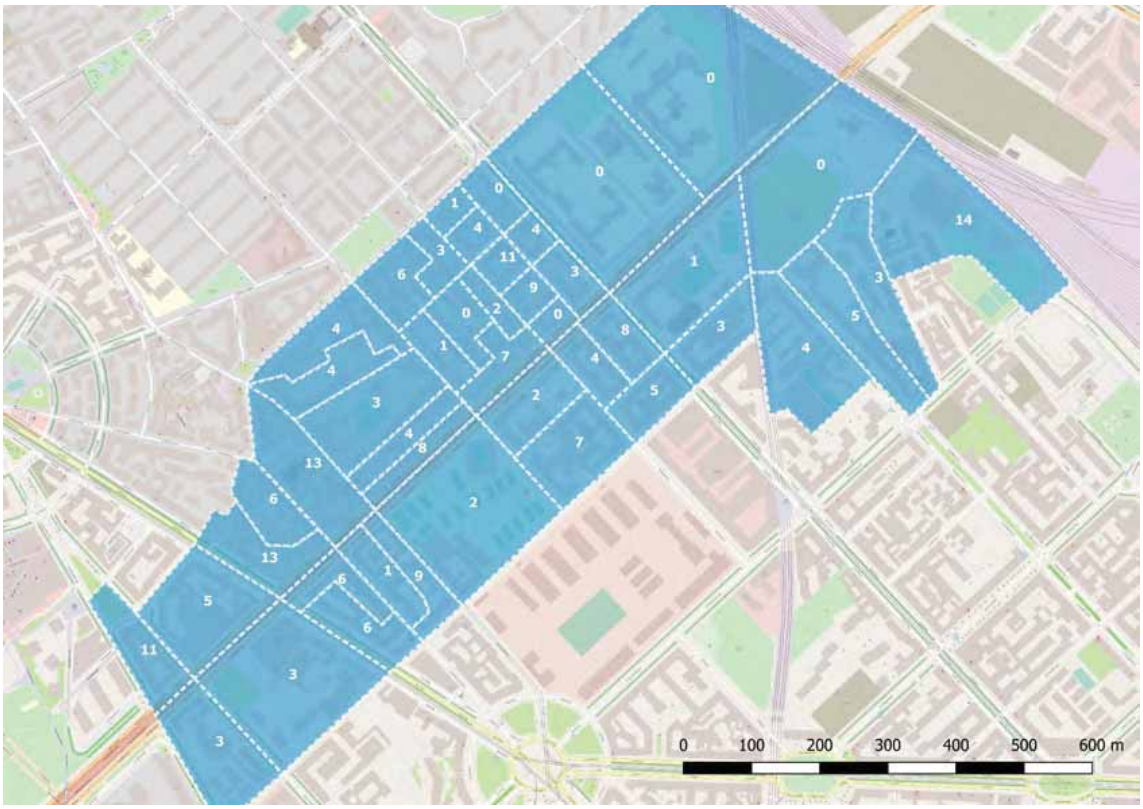
VII.29

VII.3.5 Unused man hours: mapping potential local labor

Among the unused local resources, person-hours are a fundamental component. The real possibility of triggering local prosuming processes depends on local availability of human resources.
Useful information on the available person-hours is obtainable by crossing age-groups with employment status within the census data by ISTAT. For the present case-study the following categories where selected:

- Total resident population aged 15 and over, unemployed seeking new employment (ISTAT, 2012).
- Total resident population aged 15 and over, non-labor force (ISTAT, 2012).

FIGURE VII.30 - Map of the unemployed population looking for a job, 2021 (Source: UNPark/Matteo Clementi)



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- Total resident population aged 15 and over, househusbands and housewifes (ISTAT, 2012).
- Total resident population aged 15 and over students (ISTAT, 2012)

Due to the restrictions associated with the past emergency, the data relating to the presence of unemployed are changing considerably. It is therefore of fundamental importance to integrate the data already mapped with what will be published by the recent census activity of 2021.

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