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FAST TRACK TO INNOVATION PROCUREMENT

OUTSTATIONS

ÁGUAS E ENERGIA DO PORTO

OUTSTATIONS

PITCH

Inspection of street lighting and solar panels with drones.

ORGANISATION DESCRIPTION

Águas e Energia do Porto (AEdP), is a municipal utility with administrative and financial autonomy, created in October 2006, whose capital is held, in its entirety, by the Municipality of Porto. This utility has as main responsibilities the integrated and sustainable management of the urban water cycle. Nevertheless, since 2021, this utility, with more than 500 employees, has, among others, responsibilities in the Energy sector, being responsible for the definition and implementation of the municipal energy strategy, as well as for the provision of comprehensive and specialized services to the people of Porto. Such as: i) monitoring and management of energy use in municipal equipment and public lighting infrastructures; (ii) construction, operation and maintenance of renewable energy production facilities for self-consumption. In 2022, the amount of the company's expenditure on innovation was approximately 383 730 euros and the value of turnover in the corresponding period was approximately 25 426 454 euros.

CHALLENGE DESCRIPTION

Photovoltaic installation inspections:

Águas e Energia do Porto (AEdP) is responsible for about 53 photovoltaic installations in the municipality of Porto, with a total installed power of approximately 1900kWp, distributed by the 7 parishes of the municipality, with prospects for growth in the coming years. Typically, the facilities have areas between 250m2 and 1500m2 and are placed on building roofs. Therefore, AEdP needs to make periodic technical inspections of the solar panels of the various photovoltaic installations of the city to be able to assess their state of conservation and operation, namely dirt, hot spots, defective modules and shade zones. And also, to survey the coverage areas for sizing and design of new photovoltaic installations. Currently, with regard to photovoltaic installations, measuring the areas and checking their state of conservation are done through traditional methods and through in-loco and in-person visual inspections. Figure 1 shows some of the existing PV installations (under AEdP responsibility) in the city of Porto.

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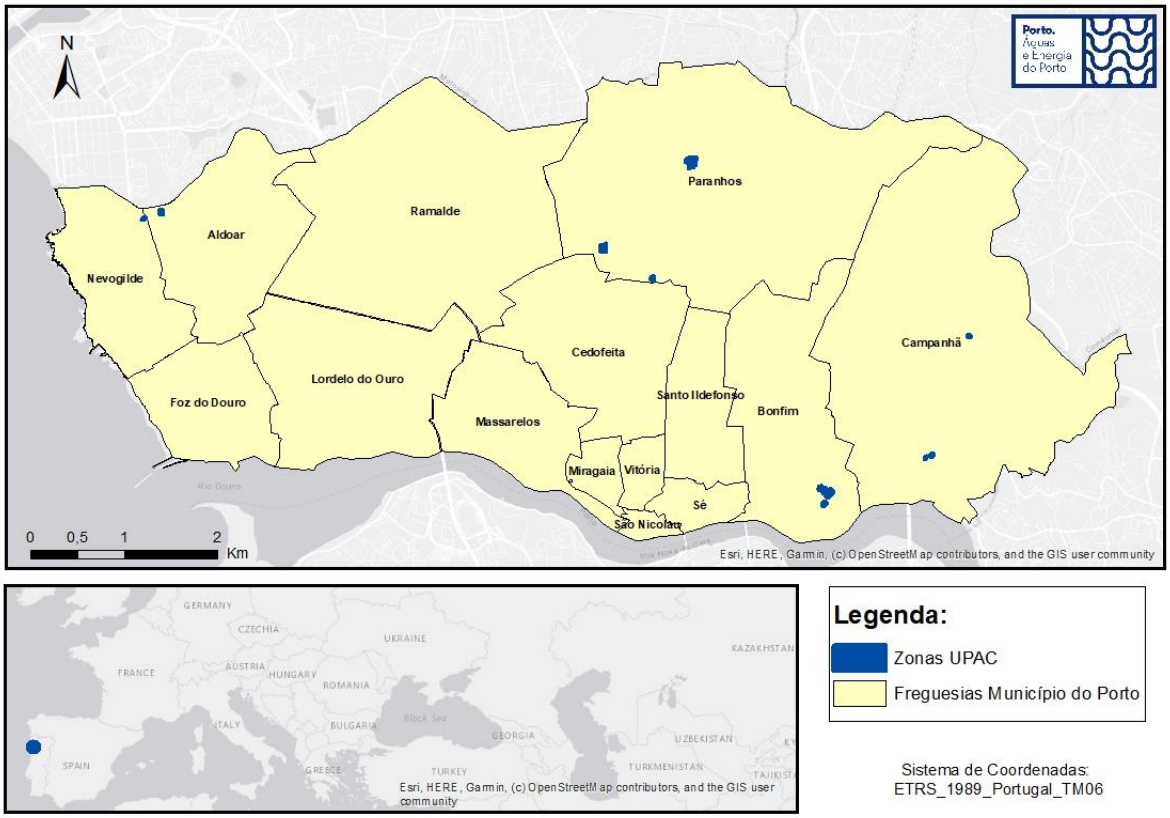
FIGURE 1 PORTO, DISTRIBUTION OF PHOTOVOLTAIC INSTALLATIONS



Public lighting inspection:

In addition, as the entity responsible for the operation and maintenance of public lighting, namely scenic lighting and green spaces (Figure 1), AEdP needs to assess its luminotechnical quality and to identify areas with lighting failure. In the municipality of Porto there are about 4000 luminaires installed in the city and distributed by approximately 190 locations. Hence, as previously referred, it is essential to evaluate its luminotechnical quality (i.e., to know if the amount of lighting is sufficient for the inhabitants) and to identify the areas of lighting failure (malfunctions, cast lamps, circuits turned off) to provide an effective and efficient service in solving the problems of public lighting that affect citizens. Currently, in the lighting of public spaces, the breakdowns and the detection of disconnected light points is done through complaints from citizens and during maintenance rounds carried out by the technical team on the ground. For this, it is necessary that the technicians travel with vehicles to the sites on a recurring basis. Figure 2 shows the distribution of the existing lighting in the city.

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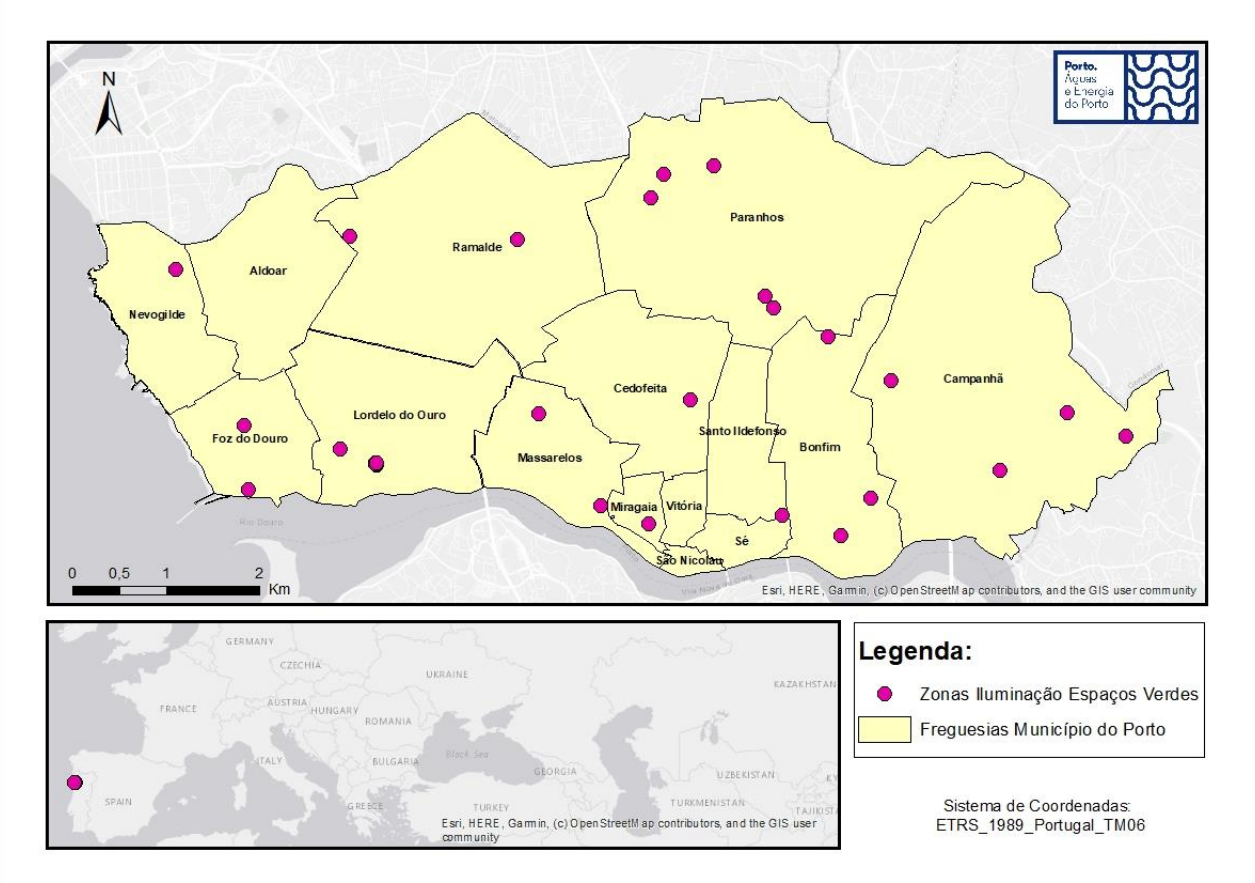
FIGURE 2 PORTO, DISTRIBUTION OF LIGHTING OF GREEN SPACES



It is possible to notice that this project has an impact for all the inhabitants, visitors and tourists of the city of Porto, so that they can enjoy a city with "green" energy and with good public lighting. It should be noted that the number of inhabitants of the city is about 232 000, and more than 2.3 million people visit the city annually. Our goal is to make the provision of services more efficient and improve the quality of life of the inhabitants, using advanced technological means and thus also reducing the carbon footprint associated with our operations.

CHALLENGE MAIN OBJECTIVES

The implementation of this solution brings autonomy and improves the efficiency and accuracy of the inspection, survey, and maintenance processes. The technological component – hardware combined with software – allows the analysis of large photovoltaic and lighting areas in a short period of time, obtaining high-resolution infrared images. Unlike a traditional manual inspection, which can take several weeks or months, the intended innovative solution – for data collection and analysis – can be performed in a few hours or days. The innovative solution will also allow preventive action in our facilities. In particular, the main objectives are:

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- Obtain an improvement in the provision of technical services → In other words, to understand and respond to problems that can arise in technical facilities proactively and faster.
- Quick response → We can measure the area of the roof of a building or check the state of dirt and shadows he solar panels in a few minutes.
- Increase citizen satisfaction → By detecting problems in public lighting in a timely manner, it will be possible to solve the malfunctions in a timely manner and thus avoiding complaints from citizens.
- Increase the availability of infrastructure → by detecting problems in photovoltaic installations or lighting in a timely manner, we can quickly intervene and thus maximize the time that the technical installations are in full service.
- Comfort and safety through lighting → with street lighting working properly, we can guarantee citizens a greater sense of security with well-lit public spaces.
- Increase the energy independence of the city → with the photovoltaic panels always operational and in good conditions of conservation, we managed to increase the production of renewable energy.

SOLUTION FUNCTIONAL REQUIREMENTS

The innovative solution should be able to collect technical data from public lighting and photovoltaic installations and process them. The solution should be an autonomous and automatic system of technical inspections of lighting and photovoltaic installations, using technological equipment: equipped with sensors (thermographic, metric, etc.), camera installed in a UAV (Unmanned Aerial Vehicle - Drone) and integrated software for data collection, processing and treatment.

More specifically, it must have the following capabilities and requirements:

- For photovoltaic installations:
  - Be remotely controlled.
  - Take pictures and film (in color).
  - Perform thermographic analysis.
  - Measure areas at a distance.
  - Measure temperatures of specific points at a distance.
  - Have the capacity and flight autonomy to collect data at height.
  - Ability to follow a previously programmed route.
  - Ability to store the collected data and/or send it remotely to a station.
  - Have software capable of visualizing and / or processing the data collected, to obtain information on: Temperature - ºC, Areas - m^2.
  - Have connectivity: Radio waves and / or GSM.
  - Have interface ports: USB and / or HDMI and / or Bluetooth.
  - Make at least one quarterly visit to each facility.

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  - Inspections should occur in the period of greatest sun exposure (from 10:00 a.m. to 3:30 p.m.), throughout the year and should not be carried out on rainy or thunderstorm days.
  - The solution to be developed (e.g., UAV) can have as a starting point the company AEdP (Rua do Barão de Nova Sintra 285, 4300-367 Porto, coordinates: 41º8'38.076"N 8º35'30.613"W) – the so-called base station – and navigate to the whole city. If there are technical constraints, one option is to drop off the UAV next to the target installation, then, when the inspection will be finished, the UAV (for example) will be collected in the same place.
  - Issue alarms or highlight collected data, whenever anomalous situations are detected, namely dirt, hot spots, defective modules and shadow zones.
  - Be able to geo-reference photovoltaic panels installed on the roof of a building or on the ground and record its coordinates (using "decimal degrees" and/or "degrees, minutes and seconds").
- For street lighting:
  - Be remotely controlled.
  - Take pictures and film (in color).
  - Perform thermographic analysis.
  - Have the capacity and flight autonomy to collect data at height.
  - Ability to follow a previously programmed route.
  - Ability to store the collected data and/or send it remotely to a station.
  - Have software capable of viewing and/or processing the data collected, to obtain information on: Temperature - ºC.
  - Have connectivity: Radio waves and / or GSM.
  - Have interface ports: USB and / or HDMI and / or Bluetooth.
  - Make at least one quarterly visit to each facility.
  - Inspections should occur in the period of least sun exposure (from 18h00 to 06h30), throughout the year and should not be carried out on rainy or thunderstorm days.
  - The solution to be developed (e.g., UAV) can have as a starting point the company AEdP (Rua do Barão de Nova Sintra 285, 4300-367 Porto, coordinates: 41º8'38.076"N 8º35'30.613"W) – the so-called base station – and navigate to the whole city. If there are technical constraints, one option is to drop off the UAV next to the target installation, then, when the inspection will be finished, the UAV (for example) will be collected in the same place.
  - Issue alarms or highlight data collected, whenever anomalous situations are detected, namely problems in lighting (dark areas, fused lamps, excessive lighting, etc.).
  - The noise emission by the drone from 2 meters away should not exceed 50dB.

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- Be able to geo-reference a point of illumination and record its coordinates (using "decimal degrees" and/or "degrees, minutes and seconds").

Compulsory functional requirements

The objective of the technological solution will be compromised if the following specifications are not met:

- Be controlled remotely.
- Photograph and film.
- Thermographic analysis.
- Measure distances and areas.
- Measure temperatures of specific points at a distance.
- Have the capacity and flight autonomy to collect data at height.
- During technical inspections, no sensitive data should be collected (e.g., images of people or interiors of private homes).
- In the case of flight, the solution to be created must respect the rules of the air space defined for the flight region of the municipality of Porto (defined by the competent authorities). Namely, the solution must respect the regulations of ANAC and EASA. Operators must register their drones and comply with no-fly zone and flight altitude restrictions. More information at: NAV Portugal (2022) and ANAC (2023).
- It is intended that the software that becomes an integral part of the solution is free of additional licenses and recurring payments. After the pilot/test phase, AEdP should be able to acquire the solution (equipment and software) in a one-time payment and be able to install the software on its own servers.
- It should be contemplated the hiring of a liability insurance for the operation of the solution that will be created, which in a first phase (initiation- tests) should be the responsibility of the promoter, and then, be transferred to the AEdP.
- Georeferencing of objects.
- Need for GPS which is important to define routes and enable the "return to home" function which forces the device to return home in case of emergency (communication failure or low battery).
- The flight range should not be less than 40 minutes.
- The mobile equipment should not weigh more than 20 kg.
- The wingspan of the drone should not be more than 1.5 meters.

Desirable functional requirements

The optional requirements are:

- Ability to send the collected data remotely to a station.
- Have GSM connectivity.
- Have interface ports: HDMI.

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- The possibility to follow a previously programmed route.

PILOT SCOPE

The pilot project will have to be tested by at least 2 operational technicians and 1 senior technician, who will learn how to handle the equipment and extract the data. There should be field and desktop testing. The language used for learning should be Portuguese (or, alternatively, English) and an instruction manual and instructions for the solution should also be provided.

Type and number of targeted end-users

End-user type	Role	Number
Field Engineer	They must know how to configure and use the equipment and software of the solution. In addition, how to validate and interpret the collected data.	3
Electrician	They must know how to operate the equipment and accompany it in the field work.	4

Language

During the pilot implementation, the Portuguese language should preferably be used in the practical training to facilitate understanding by all users. Or alternatively the English language.

Other aspects

It is important that the solution has a good relationship between the hardware equipment and the software that will interpret the information received. That is, the software that comes to be used in the solution must have good compatibility and integration with the hardware.

In Portugal, for free flight of the Drone, you cannot fly higher than 120 meters. To ascend above 120 meters you need a special permit.

It is mandatory to register the drone on the platform provided by ANAC: https://www.anac.pt/vPT/Generico/drones/registo_uas/Paginas/OperadoresdeUAS.aspx

PILOT SET-UP CONDITIONS

Ethical, legal or regulatory

Besides complying with the legislation in force in Portugal, we do not foresee any constraints in the company's operation of the equipment or in the collection and processing of this technical data.

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Technological

The systems and servers required to run the pilot will be hosted on our physical servers located in-house. The technical solution should be able to be configured locally – if needed by a skilled user of AEdP – and be able to exchange information (read and write data) with Microsoft Office systems or equivalent. If applicable, we accept that during the development and testing phase of the system, the software is hosted in the server company or only accessible via the web.

EXPECTED IMPACTS AND KPIs

Some of the indicators identified are:

- Reduction of out-of-service times, of technical installations, by being able to practically and effectively deter anomalies and make their repair: (-50%);
- Reduced response times, due to the fact that it is more important to be able to identify the problems in the facilities and to be able to trigger the intervention, and also because in just a few minutes it is possible to make the photographic survey or measurements: (-20%);
- Increase in the number of technical inspections, due to the ease and speed with which the service will be able to be done: (+40%).

BUSINESS OPPORTUNITY

Market size

Internally, in our company this project would be replicable in at least 3 other activity areas, with about 20 users, having an impact for all citizens in the municipality of Porto.

In Portugal, there are more than 300 municipalities and public companies with responsibilities in the area of energy (more particularly, in public lighting and photovoltaic panels), with at least 600 potential users working in them, causing a difference in the lives of thousands of people. This situation also occurs in municipalities and companies from countries all over Europe. In this sense, this solution has the potential to be implemented internationally, which increases its importance at a global level.

The solution created here can be extended in a standardized way with the same technology to other sectors of activities, inside and outside the organization, with great possibility of growth, due to the constant automation of the monitoring and control systems of the technical installations.

Adoption plans

We intend to expand the solution in our organization if the pilot is successful, namely with the purchase of more equipment, and to apply the same solution in other areas of the company's activity as well.

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