



USE CASE 11:

Digital permits for drone-based inspections in linear infrastructures





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Use case 11: Digital permits for drone-based inspections in linear infrastructures

Use case identification

Table 1. Identification of use case 11.

ID	Name of Use Case	Geographical scope	Cross-sector domains			Interoperability layers
			Electric	Mobility	Data	
BEG.11	Digital permits for drone-based inspections in linear infrastructures	<input type="checkbox"/> Local <input type="checkbox"/> Regional <input type="checkbox"/> National <input checked="" type="checkbox"/> Cross-border <input type="checkbox"/> Outermost	<input type="checkbox"/> Customer <input type="checkbox"/> DER <input type="checkbox"/> Distribution <input type="checkbox"/> Transmission <input type="checkbox"/> Generation	<input type="checkbox"/> Customer information <input type="checkbox"/> Vehicle <input type="checkbox"/> Energy station <input checked="" type="checkbox"/> Infrastructure <input checked="" type="checkbox"/> Traffic and logistic	<input checked="" type="checkbox"/> Edge <input type="checkbox"/> Fog <input checked="" type="checkbox"/> Cloud	<input type="checkbox"/> Component <input type="checkbox"/> Communication <input checked="" type="checkbox"/> Information <input checked="" type="checkbox"/> Function <input checked="" type="checkbox"/> Business

The scope and objectives of the use case

Table 2. Scope and objectives of use case.

Scope and Objectives of the Use Case	
Scope	<p>Drone inspections have demonstrated to be a very efficient approach to support maintenance operations, acquiring information quickly and in a safety manner, that otherwise cannot be obtained with traditional procedure or visual inspections from a distance. However, drone operation is regulated at multiple levels (European, National and Regional) and depends on many authorization bodies (air traffic control provider, traffic directorate, environmental agencies...) that takes months or even a year to validate a flight application. This dependency between different validation authorities or agents means that this method remains exceptional for a mature and established technology. A digital platform based on blockchain to manage digital permits for drone-based maintenance applications can reduce the bureaucracy effort and time, making this type of inspections accessible, manageable and safer, validating in a one platform all the legal and regulatory conditions, especially in cross-border contexts.</p>
Objective	<ul style="list-style-type: none"> • Reduction of the time needed to obtain a flight permit to perform infrastructure inspections with drones. • Reducing the risk of human error in the drone flight validation process while ensuring compliance with all applicable regulations. • Improved maintenance of linear infrastructure under cross-border conditions with more frequent and accurate inspections. • Reduction of traffic disruptions or undesired effects during infrastructure inspections, ensuring road safety. • Improve coordination between air safety agencies and public authorities to promote the use of drones to improve road safety, infrastructure maintenance and environmental protection.
Reference country(ies)	Spain, Portugal, France
Related Business Case	Maintenance Operations, Drone Operations in cross-border conditions



Possible stakeholders Maintenance managers, linear infrastructure authorities, air traffic controllers, drone operators

Narrative of the use case

Infrastructure managers recognise that drone inspections provide valuable information to implement accurate maintenance plans, which otherwise could not be done with the same scope and efficiency. However, drone inspections require lengthy bureaucratic procedures that slow down the process and make it impossible to schedule such inspections on a regular basis, which does not allow for a thorough follow-up of possible damage and does not fully integrate into the maintenance inspection portfolio of linear infrastructures. The procedure involves the permission of different authorities at local, regional, national and cross-border level such as infrastructure management bodies, maintenance, traffic, air control... In addition, the inspection requires suitable weather conditions (e.g. low wind speed) which also limits the time window for carrying out the inspection, which may lead to revocation of the permit.

Digital permits between air traffic control provider, authority bodies and other stakeholders may minimize the waiting period, making more suitable the integration of this innovative inspections into the usual maintenance procedures of linear infrastructures.



Figure 1. The framework of the use case 11.

An ODP with blockchain can connect the stakeholders related to linear infrastructure inspections quickly and securely, in a way that establishes the governance model and permits according to the countries involved. The infrastructure manager (country A) requests the inspection (work order) based on their support decision system and the



maintenance management system of the entire value chain. Authorities sharing the ownership or legal responsibilities about the linear assets receive the request (scope, duration and legal compliance) and generate the validation form based on the inspection details. If some stakeholder requests clarifications or additional compliance, this event is communicated automatically to all the stakeholders to minimize the number of iterations. In case all stakeholders agree and validate the request, the inspection date and duration are confirmed and can be executed.

Diagram of the use case

The diagram of the use case 11 is presented in Figure 2 and Actors' actions and scenarios' descriptions are presented in Table 3 and Table 4, respectively.

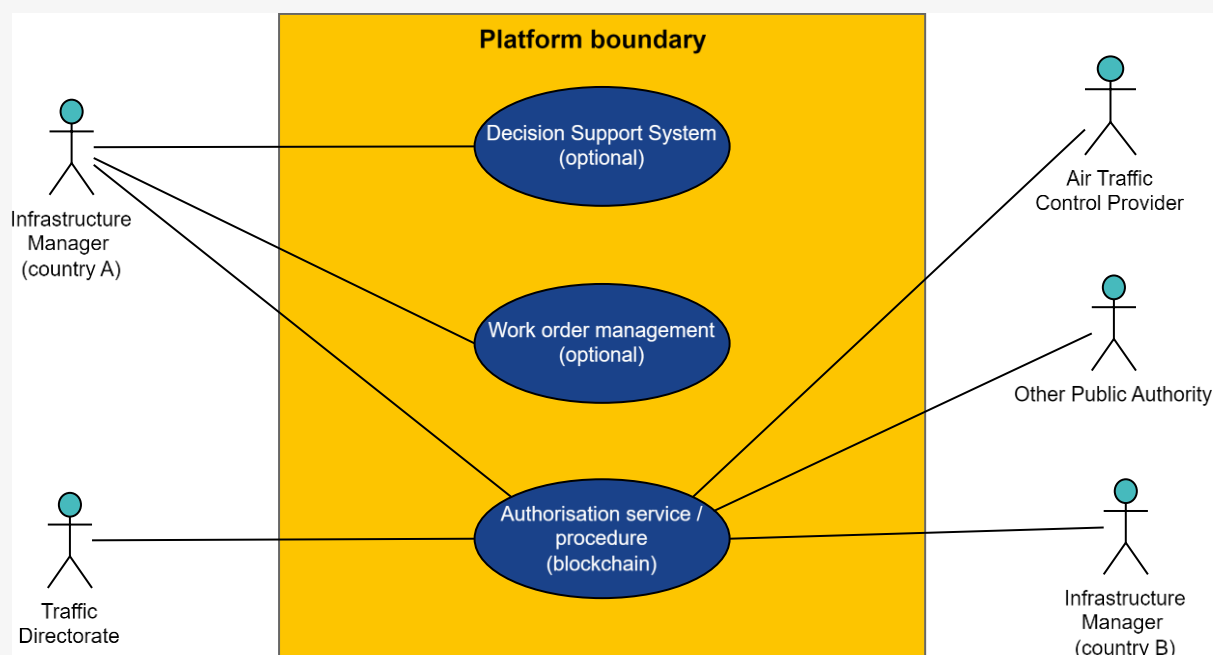


Figure 2. The diagram of the use case 11.

Actors of the use case

Table 3. Description of the actions of use case 11 actors.

Actor Name	Actor Type	Actor description	Actions	Standards
Infrastructure manager (country A)	Role	National authority or the company responsible for maintaining cross-border linear infrastructure.	It makes the decision to carry out a drone-based inspection of a cross-border infrastructure. It generates the work order for a work operator. It generates the request with the drone operator and work order details (location, duration and specifications) It may receive requests to clarify some details or the final validation to carry out the inspection.	IEEE 3205-2023 IEEE 3801-2022



Traffic Directorate	Role	National Authority responsible for road mobility	It receives requests from the infrastructure manager. It assesses the traffic impact of the inspection (if appropriate) and can generate an additional query for further details. It validates the permission and prepares the operation to support the intervention.	IEEE 3205-2023 IEEE 3801-2022
Air Traffic Control Provider	Role	National Authority to regulate flights	It receives requests from the infrastructure manager. It evaluates the legal conditions of the request (licenses, restrictions...) It may generate additional queries for further details. It validates the intervention date and duration.	IEEE 3205-2023 IEEE 3801-2022
Other public authority	Role	Any other public authority responsible for getting permissions	It receives maintenance intervention request. It evaluates the compliances with National/Regional regulations. It may generate additional queries for clarification. It validates the intervention.	IEEE 3205-2023 IEEE 3801-2022
Infrastructure manager (country B)	Role	National authority or the company responsible for maintaining the linear infrastructure beyond the cross-border	It replicates the request of Country A for National compliance of country B.	IEEE 3205-2023 IEEE 3801-2022

Referenced standards:

- IEEE 3205-2023 IEEE Standard for Blockchain Interoperability Data Authentication and Communication Protocol
- IEEE 3801-2022 IEEE Standard for Blockchain-based Electronic Contracts

Scenarios

Table 4. Description of use case 11 scenarios.

S.No	Scenario Name	Triggering Event	Scenario Description	Primary Actor
BEG.11 S1	Application request	The user generates a request for flight authorization.	The application contains the flight details (drone, drone operator license, location, duration, estimated date...)	The infrastructure manager (country A)
BEG.11 S2	Application validation	All the actors validate the flight application	All actors receive the application details and validate their specific legal and regulatory conditions	Traffic Directorate Air Traffic Control Provider Other public authority



				Infrastructure manager (country B)
BEG.11.S3	Application rejection	Some actors reject the application because the action is prohibited	Some actor detects that the application does not fulfil with legal or regulatory conditions	Traffic Directorate Air Traffic Control Provider Other public authority Infrastructure manager (country B)
BEG.11.S4	Modification request	Some actors request additional information due to missing or unclear information or for non-compliance	Some actor detects that some information is missing or unclear or the application does not fulfil with legal or regulatory conditions	Traffic Directorate Air Traffic Control Provider Other public authority Infrastructure manager (country B)

Policy and digitalisation needs

Table 5. Description of use case 11 policy and digitalisation needs.

Policy needs	<p>This use case has been generated as need of main Spanish cross-borders. Therefore, current regulations between Spain, Portugal and France are described as follows:</p> <p>Spain</p> <ul style="list-style-type: none"> • Regional authorities may issue their own drone regulations. • Drones must always be flown within the visual line of sight. During first-person view (FPV) flights a second visual observer must monitor the drone with the eye and be in direct contact with the pilot. • Drone pilots must maintain a distance of at least 8 km to airports in uncontrolled airspace, or 15 km on approved beyond visual line of sight (BVLOS) flights. • Drone pilots must maintain 150 m from buildings, and 50 m or more from people not involved in the flight. • For flights in national parks, you need permission from the AESA (Spanish Air Security Agency). The use of drones in no-fly zones must be approved by the Spanish Ministry of Defense (processing time is approximately one week). • AESA has established procedures to obtain official flight permits. • EANAIRE has a website (app) to check the restrictions applied in a specific area like protected natural space, airspace, safety area, etc. • As exception, the Royal Decree 1036 establishes in Article 44 that in the event of situations involving serious risks, catastrophes, or public calamities, and if requested to do so by the public authority responsible for managing such situations, licensed Remotely Piloted Aircraft System (RPAS) operators may conduct flights that do not comply with the conditions and limitations of this Royal Decree. In the event of an RPAS flight being conducted in a flight information zone or within protection areas covered by Article 23 ter.3, letter b) of Royal Decree 552/2014 of 27 June, the pilot must coordinate with the corresponding air navigation service provider beforehand. <p>Portugal</p> <ul style="list-style-type: none"> • Drones may not be used to capture images or video without permission from the National Aeronautical Authority (ANAC)
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	<ul style="list-style-type: none"> • Drone pilots must always maintain a visual line of sight with their drones while flying. • Drones are prohibited in open air concentrations, in the specific operational protection areas of airports and aerodromes, and in facilities where sovereign bodies, embassies and consular representations, military installations, security services, police and civil protection missions, prisons and educational centers of the General Rehabilitation and Prison Services Directorate. <p>France</p> <ul style="list-style-type: none"> • The drone operator must be registered and needs proof of competency. • The drone must always be in a visual line of sight (VLOS). • The drone is flown at no more than 120 m above ground level. • The drone must not carry any dangerous goods or drop any material. <p>Barriers and limitations</p> <ul style="list-style-type: none"> • Although National regulations derive from the European Union Aviation Safety Agency (EASA), every country has their own restrictions (e.g. distances, areas, number of authorization entities...) • There is not a cross-border (digital) procedure to fly a drone. The flight must fulfil both restrictions at the same time, taking months and up to one year to obtain the permit. <p>In Spain, specific rules may apply at regional level, increasing the steps and time to get the permission.</p>
<p>Digitalisation needs</p>	<ul style="list-style-type: none"> • Standardization of the validation procedure and governance models for drone-based inspections (e.g. EASA) • Digital platform (or data space) connecting National and Transnational authorities to validate cross-border drone-based operations, and existing flight monitoring systems (e.g. ENAIRE in Spain). • Specific blockchain standards to validate digital permits for public administration.