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SURVANT

Surveillance video archives investigation assistant

D2.4 - Pilot scenarios

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1	Engineering Ingegneria Informatica S.p.A.	ENG	Italy
2	Ethniko Kentro Erevnas Kai Technologikis Anaptyxis	CERTH	Greece
3	Innovation Engineering srl	INNEN	Italy
4	United Technology Research Centre Ireland, Limited	UTRC	Ireland
5	Ayuntamiento de Madrid	ADM	Spain

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V0.8	26/09/2017	Delivery candidate	UTRC	Version ready for peer review
V0.9	28/09/2017	Final	UTRC	Final frozen

Definitions, Acronyms and Abbreviations

ACRONYMS / ABBREVIATIONS	DESCRIPTION
LEP	Legal, ethical and privacy

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Executive Summary

The purpose of this document is to report the work done in WP2 with respect to the identification of the relevant use cases that will finally underpin both the system specification and the technical developments of the SURVANT project. The requirements and use case analysis (Task 2.1) aim at providing the basis for the definition of user scenarios with respect to the proposed infrastructure, analysing and providing the basis for the system specifications.

This report focuses on a comprehensive description of the Pilot scenarios for the project. These scenarios were designed and elaborated after comprehensive discussions with the user groups in the consortium. As a consequence, the scenarios described in this document originate in real events and real challenges faced by law enforcement authorities. Hence, they are not artificially created but carefully drafted in conjunction with the project users to ensure a broad and useful functionality of the final SURVANT system.

The aim is to plan activities to define the pilots, providing relevant data sources and contents to use for the demonstration, the actors to involve in the scenarios, the system services and functionalities to put in each scenario and pilot, the expected benefits and added value introduced by the system.

A brief introduction to the whole document and the adopted user-centred design approach of SURVANT is given in section 1. The actual pilot scenarios of the project are comprehensively described in section 2.

1 Introduction

1.1 User-centred approach

The SURVANT project aims to offer a unified framework for the analysis of video footage that will assist users to have a better situational understanding and automate time-greedy tasks in their work. The proposed solution will enable the collection of video footage from multiple repositories/sources in a quest to accumulate a complete view of an investigated event. It will enable connection to heterogeneous video repositories, offering connection interfaces, support for multiple video formats and metadata, and easy geo-registration of the cameras. Privacy-related provisions for ethical personal data transfer and usage are built-in from the design phase, covering all system aspects: repository connections, user access rights, inter-module data transfer and result visualization.

To achieve this, the SURVANT consortium will follow a user-centred design approach during its development process as depicted in Figure 1.



Figure 1 - SURVANT user-centred approach

The SURVANT use cases are at the top of the development cycle. These cases were designed and elaborated after comprehensive discussions with the user groups in the consortium. As a consequence, the pilot scenarios described in this document originate from the report *D2.1 Requirements and use case* that identifies the use cases through which the technologies to be developed within SURVANT project will be demonstrated and validated.

1.2 Pilot definition steps

SURVANT aims to develop an advanced and expandable framework that will serve police investigators in their investigations and significantly reduce the required investigation time by utilizing automatic processes for analysing multimedia contents. As the system is being built using user-centred design approach, throughout analysis and discussions driven by end users in the SURVANT consortium resulted in definition of Pilots based on real use cases and scenarios. This deliverable presents a set of concise plans for SURVANT pilots, their execution and testing on data acquired from partners. The definition and planning of the SURVANT Pilots consists of concrete steps summarised below.

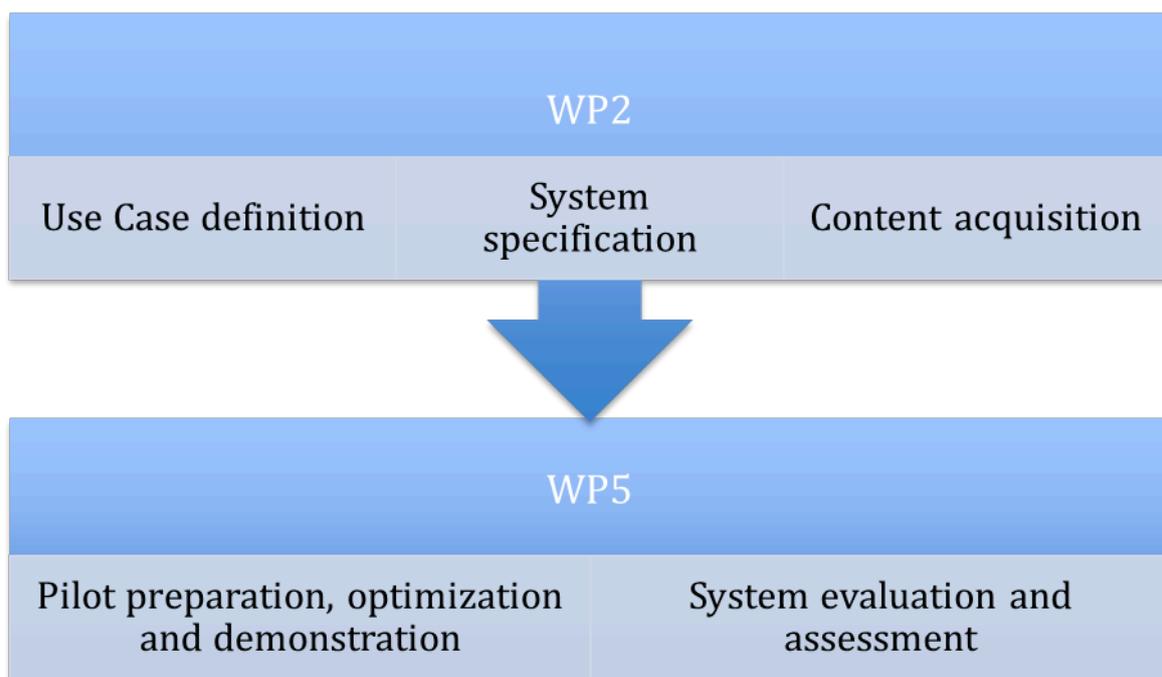


Figure 2 - SURVANT pilots methodology

The chosen use cases originate from real events and are based on real challenges faced by police forces and crime investigators. Content Acquisition represents important step towards development of robust multimedia and textual processing solutions and testing SURVANT pilots in real environments and using real data. Significant effort and resources have been allocated for data gathering at the beginning of the project. The data gathered for each use case ensures a coherent approach among SURVANT developers

since techniques developed independently by a given partner can be easily integrated in the same framework assuming the same data has been used for algorithm development. As all SURVANT Pilots will be deployed and tested strictly in compliance with relevant regulatory requirements, the legal, ethical and privacy (LEP) requirements have been taken into account during the data acquisition procedures. The detailed report on data acquisition for each Pilot is provided in following sections of this Deliverable.

Based on results from use cases (Task 2.1 User requirements and use cases) and system specifications (Task 2.2 System specification), a common set of plans for each Pilot has been defined to ensure efficient deployment, execution and evaluation of each pilot. The specifications of Pilot demonstration test-beds will be reported in the report D5.4 Pilot installation. Concrete evaluation metrics for each Pilot will be defined in the upcoming period and together with evaluation results will be reported in report D5.5 Pilot evaluation and assessment. Following sections outline the definition and planning of each SURVANT Pilot together with detailed analysis of the data acquired.

2 SURVANT pilot scenarios

The SURVANT pilot scenarios focus on the user story “Perform investigation” described in *D2.3 System Architecture*.

2.1 Acquisition

2.1.1 Acquisition procedure

An admin needs to prepare data source, in order to create information related to future investigation.

First of all an admin user needs to create and add users, these users will belong to the investigation as investigators, surveillance owners or surveillance controllers.

Then the following hierarchy should be deployed:

- Video Repositories, which contain a related set of cameras
- Cameras, which contain a related set of video footages
- Video footages

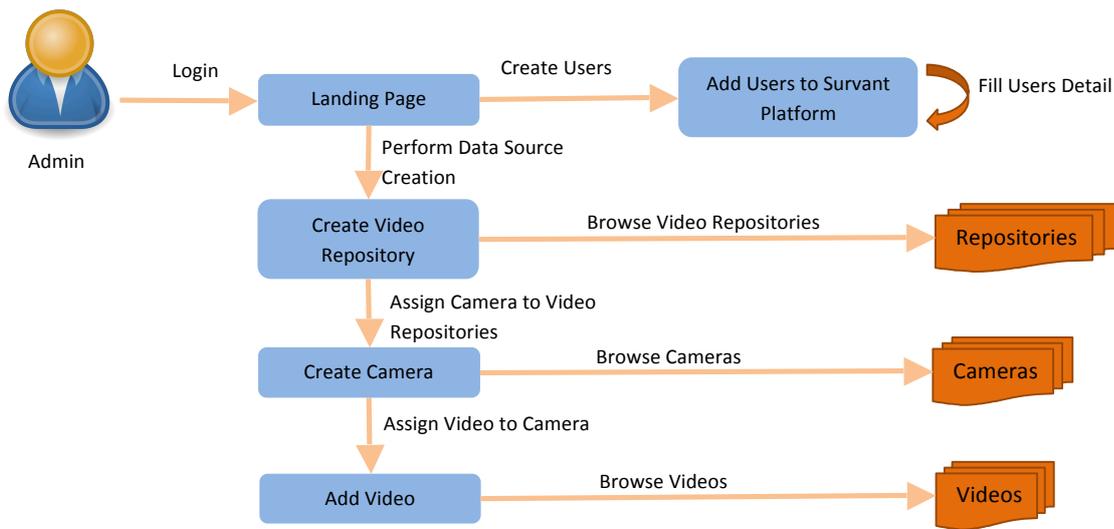


Figure 3 - Users and Data Source Creation

Then the admin user can follow the creation wizard to elaborate an Investigation.



Figure 4 - Create investigation wizard flow

2.1.2 Recordings acquisition details

Describe for each investigation use case which data are you going to recorded

Use Case 1 – Aggression

Scenario 1 – Beat and Run Away

1. Person walking down the street, another approaches him from behind and tries to remove the bag by pulling on it. When trying to prevent it, a fight begins and the one pulling finally takes the bag and runs away.

2. Person walking down the street, two others approach him from behind. One holds him by the body while surrounding him with his arms, while the first punches him in the belly; they take away his cell phone and his wallet and run away.

3. Person walking and stumbles with another that comes in the opposite direction, they both get angry and a fight begins.

4. Two people walking down the street, one of them wearing in a football team jersey, they come cross with several people who tell him off for the shirt and they end up fighting.

5. A walking person is surrounded by 3 or 4 people; they start to push him from different sides and finally steal what he has and run away.

Use Case 2 – Theft

Scenario 1 – Pick Pocketing

1. Person walking, another approaches from behind, puts his hand in his backpack, takes his wallet and leaves.

2. Person walking with a backpack stumbles frontally with another person, a moment that is taken as advantage for a third one to remove the cell phone from his pants pocket.

3. Person looking at a map of the city, leaving the suitcase on the floor with a briefcase and a laptop bag on top of the suitcase. Someone asks something while a third person takes the laptop and leaves.

4. A person walking where two others stop him and ask him for something by showing him a map and while they talk to him, turn around, etc., they remove his wallet.

5. People sitting on a terrace, one of them with the bag hanging from the chair. Someone stumbles next to them, and while looking at the falling person, another person reaches into the bag and removes the wallet from the inside.

6. People sitting on a terrace and being distracted by something, suddenly someone takes the cell phone that was on the table.

Use Case 3 – Detection of Public Vandalism

Scenario 1 – Vandalism against parked vehicles

4. A person approaches a Uber car and makes a graffiti against the Uber service.

Scenario 2 – Defacing of buildings

1. Two people walking, they approach a wall and begin to make graffiti on it.

2. A person approaches a wall and begins to paint graffiti

3. A person approaches urban furniture and starts to paint graffiti on it.

Use Case 4 – Scene Monitoring

Scenario 1 – Building Monitoring

1. Leave the camera fixed at the entrance of a portal to see who enters and who leaves throughout an entire morning.

Use Case 5 – Missing Person

Scenario 1 – Vulnerable individual reported missing

Use Case 6 – People Tracking

Scenario 1 – Assault on a Person

Scenario 2 – Person of Interest Tracking

1. Person walking with a suitcase / bag / backpack; other three are following in the vicinity and partly surrounding him to find the best time to steal.

2. Person walking with suitcase and backpack; two or three people pass by in the other direction and as they cross with the first one, suddenly they change direction and start to follow him.

Scenario 3 – Detect subsequent criminal behaviour

2.2 Pilot Scenario 1: Search by sentence

This story describes how the investigator can perform an investigation using SURVANT’s complex query formulator feature and navigate through the bundle of resulting high level events. Investigator can watch the related videos having a quick reference to the detected events. Primary actor is Investigator as User.

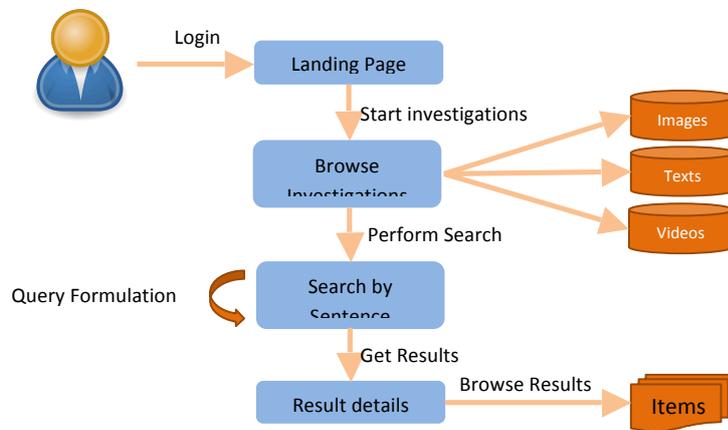


Figure 5 - Pilot scenario 1 flow

The investigator logs into the portal and gets access to the investigation assigned to him via the browse investigations section where he selects the “perform -> search by sentence” option available in correspondence of the investigation entry. Then he submits a textual query into the input field and awaits for the results to be shown. The investigator can explore the results clicking on the thumbnail presented in the result set to play the video where the thumbnail’s been extracted from and look at the related relevant events.

2.2.1 Possible use cases involved

The relevant use cases centre around the analysis step carried out by an investigator subsequent to surveillance video having been processed and analysed by SURVANT. In the table below we note the relevant product use cases with sample queries. Note that we assume that temporal and spatial constraints are applied to the search (approximate time and location constraints)

PRODUCT USE CASE	SAMPLE SEARCH 1	SAMPLE SEARCH 2	SAMPLE SEARCH 3
PUC 27: Investigate hypothesis for Beat & Run Away	Find a person running near a person with a particular coloured top falling down	Locate an incident of assault	Locate a group of people fighting
PUC 28: Investigate hypothesis for Pick Pocketing	Locate incidence of tail gating involving a person with a particular coloured top and	Locate incidence of person picking object and person on a motorbike	Locate incidence of abandoned bag

	bottom		
PUC 29: Investigate hypothesis for Vehicle Vandalism	Find a person with a particular coloured top running away from a car	Locate incidence of graffiti making	Find person loitering
PUC 30: Investigate hypothesis for Building Vandalism	Find person loitering at the building	Find group of people loitering at the building	Locate incidence of graffiti making
PUC 31: Investigate hypothesis for Building Monitoring	Find people loitering outside the building doorway	Find people entering the building together	Find people meeting outside a building
PUC 32: Investigate movements of missing person	Find a person wearing a red top and a black bottom	Find incidence of person walking together with person wearing particular colours	Find person loitering with particular colour clothes

2.2.2 System evaluation

SURVANT will be assessed both through a live ‘hands-on’ analysis by end users and through a qualitative evaluation of the efficiency gains that SURVANT can bring over conventional practices.

End users will interact with a live SURVANT deployment with the assistance of ADM by submitting some keywords describing a new investigation being conducted. SURVANT will respond with a list of query results ranked in terms of the relevance estimated by SURVANT. The query results can be explored by the user for closer inspection.

The user will assess the outcome for relevance and accuracy and evaluate whether the automation of complex tasks offered by SURVANT brings efficiency improvements to the investigation process in terms of time and effort.

The user will also evaluate SURVANT from a usability perspective and suggest avenues for improvement.

PRODUCT USE CASE	FUNCTIONAL REQUIREMENT	EVALUATION CRITERIA
PUC-29	FR-53	UI presents editable fields for capturing investigation parameters
PUC-27	FR-67	Ability to view a investigation’s details from the UI
PUC-28	FR-70	Ability to view list of investigations in the UI
PUC-30	FR-73	Ability to remove an investigation through the UI
PUC-27, PUC-28, PUC-29, PUC-30, PUC-31	FR-90	UI presents means of selecting the incident zone, choosing one or more events to identify and initiate search

PUC-27, PUC-28, PUC-29, PUC-30, PUC-31, PUC-32	FR-97	UI enables users to annotate key items of analysis
PUC-27, PUC-28, PUC-29, PUC-30, PUC-31, PUC-32	FR-104	UI enables users to view investigation timeline

2.3 Pilot Scenario 2: Search by image

Search by image section describes how the user can obtain useful investigation results searching for a visual query among the videos related to an investigation interacting with the platform. Besides the text-based search, the user will have the opportunity to search the analysed videos using an image. The image can be a file that is uploaded to the system or a cropped image selected from a frame of the analysed videos. The query is being analysed and compared with the analytics extracted from the relevant videos and stored into the SURVANT database. All instances similar to the one queried are returned to the user for inspection.

Search by image functionality can be used to re-identify a detected object in other parts of the video or other videos from the same or different cameras to assist tracking the object across multiple cameras. Moreover, it can be used to identify persons or objects of interest that have not been yet spotted in the examined videos but are available from other sources.

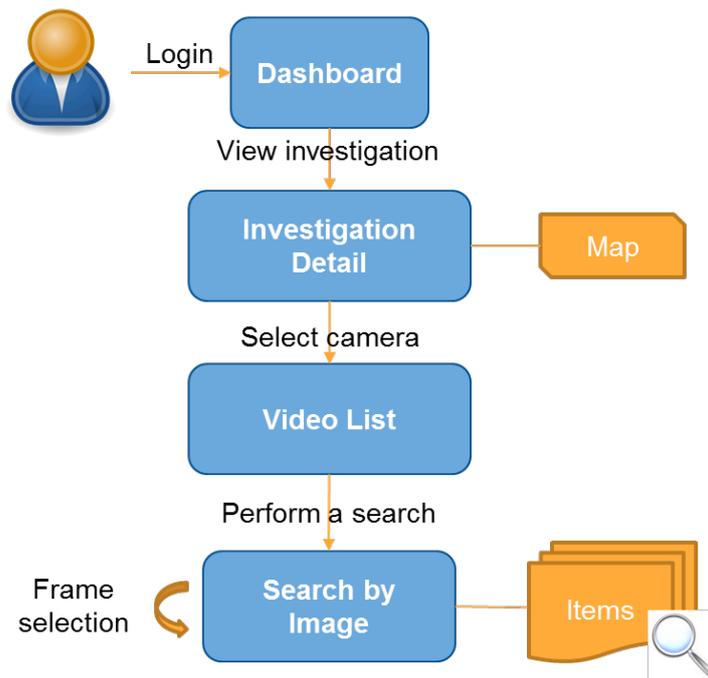


Figure 6 - Pilot scenario 2 flow

The investigator logs into the portal and gets access to the investigation assigned to him via the browse investigations section where he selects the “perform -> search by image” option available in correspondence of the investigation entry. From the map, the investigator picks a camera and starts playing one of its videos. The investigator pauses the player, draws a selector rectangle on the frame and submits the search request including details about item to be traced, the period to search into and the geographical

area of the research. The results will be shown in a list view and will be available for an in-depth exploration by clicking on the thumbnails shown into the list.

2.3.1 Possible Use cases involved

The relevant use cases again centre on the analysis step carried out by an investigator subsequent to surveillance video having been processed and analysed by SURVANT. In the table below we note the relevant product use cases with sample queries. Note that we assume that temporal and spatial constraints are applied to the search (approximate time and location constraints)

PRODUCT USE CASE	SAMPLE SEARCH 1	SAMPLE SEARCH 2	SAMPLE SEARCH 3
PUC 27: Investigate hypothesis for Beat & Run Away	Locate the victim from a description of what they were wearing in the video and capture a thumbnail. Search by image with event type of falling down	Locate the suspect from a description of what they were wearing in the video and capture a thumbnail. Search by image with event type of kick/punch	Search scene for incidences of where victim and suspect appear together
PUC 28: Investigate hypothesis for Pick Pocketing	Using thumbnail of victim search for appearances with event type of tailgating	Search for victim thumbnail correlated with presence of bike	Search for victim thumbnail correlated with event type of meeting
PUC 31: Investigate hypothesis for Building Monitoring	Find appearances of particular person entering or exiting the building	Find instances of particular person meeting with other people	Find instances of particular person standing outside the building
PUC 32: Investigate movements of missing person	Locate all appearances of person matching victim image	Locate incidences of person meeting someone else	Locate incidences of person and tail gating

2.3.2 System evaluation

The Pilot Scenario 2 will be evaluated in two stages. During the first stage, system components will be evaluated against the ground-truth manually created to test the core video/image processing modules. In the second stage, police officers and investigators will perform the evaluation, by using the system in staged situations representing real criminal investigations. All collected feedback from the evaluation stage will be used to propose further improvements to the SURVANT system.

PRODUCT USE CASE	FUNCTIONAL REQUIREMENT	EVALUATION CRITERIA
PUC-27	FR-67	Ability to view a investigation’s details from the UI
PUC-28	FR-70	Ability to view list of investigations in the UI
PUC-27, PUC-28, PUC-31	FR-90	UI presents means of selecting the incident zone, choosing one or more events to identify and initiate search
PUC-27, PUC-28, PUC-31, PUC-32	FR-97	UI enables users to annotate key items of analysis
PUC-27, PUC-28, PUC-31, PUC-32	FR-104	UI enables users to view investigation timeline

2.4 Pilot Scenario 3: Geographical analysis

User will learn more spatial awareness about the investigation dynamics performing the tasks contained into the geographical analysis story. This feature enables the operator to automatically track a detected target over the map estimating the occurrences of target’s event extracted from correlated footages into a certain time window. The resulting set of information will define a recommended path via the built-in module for multi-camera video analysis. Investigator as User is the primary actor of the story.

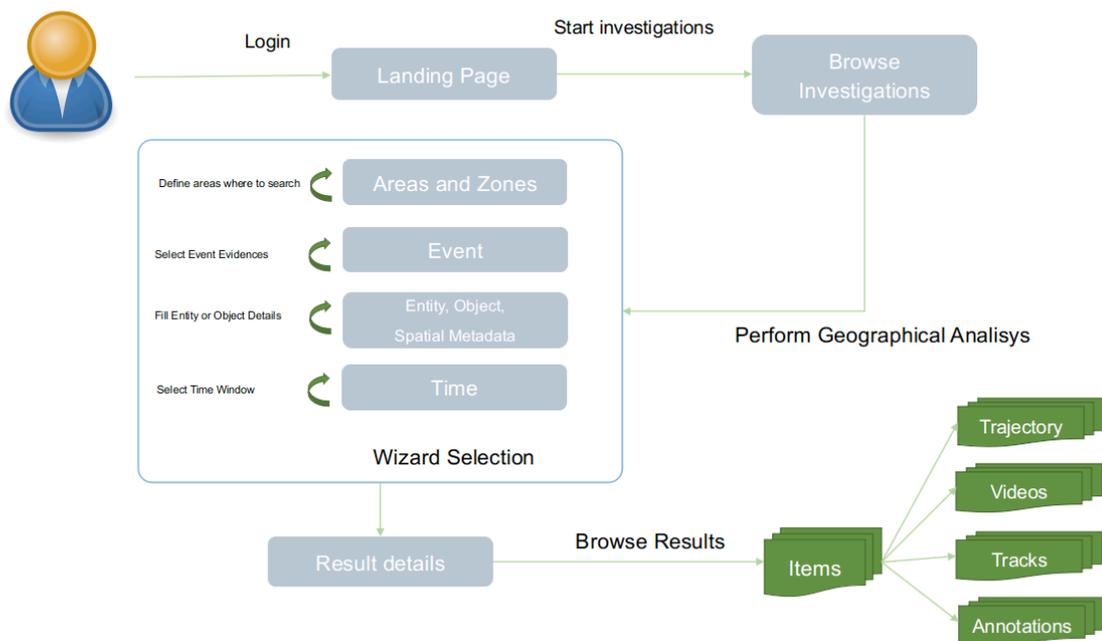


Figure 7 - Pilot scenario 3 flow

The investigator logs into the portal and gets access to the investigation assigned to him via the browse investigations section where he selects the “perform -> geographical analysis” option available in correspondence of the investigation entry. The user traces the area of interest on the map and a series of incident zones; the area of interest is the geographical region where the analysis will be performed and the incident zones are points where something relevant happened in the context of the investigation. Investigator proceeds to insert a type of event (i.e. Vandalism) , selects an entity (i.e. People -> Person -> Male) , an object (i.e. Object -> Clothes -> Hat) and spatial data among the available options (i.e. Restaurant -> McDonald’s). At last, the investigator selects the time interval and submits the query. The system will respond with a trajectory match extracted via the trajectory miner module and shown into a map as well as the relevant events collected in a list view that will be available for an in-depth exploration by clicking on the thumbnails shown into the list. The investigator may annotate the results with some comments for team communication reasons or as reminder of important notes.

2.4.1 Possible Use cases involved

The relevant use cases centre on the analysis of a person’s movements and behaviour over a geographical area. This analysis would be initiated by an investigator subsequent to surveillance video having been processed and analysed by SURVANT. In the table below we note the relevant product use cases with sample queries. Note that we assume that temporal and spatial constraints are applied to the search (approximate time and location constraints)

PRODUCT USE CASE	SAMPLE SEARCH 1	SAMPLE SEARCH 2	SAMPLE SEARCH 3
PUC-32: Investigate movements of missing person	Submit image of person captured on surveillance footage to search the Area Of Interest and view ranked trajectories	Submit image and prioritize trajectories than involve suspicion of assault	Submit image and prioritize trajectories that involve suspicion of tail gating
PUC-33: Investigate suspect movements after criminal incident	Submit image of person captured on surveillance footage to search the Area Of Interest and view ranked trajectories	Submit image and prioritize trajectories than involve person meeting and walking with another person	Submit image and prioritize trajectories finish with entering a building
PUC-34: Investigate movements and behaviour of suspicious individual	Submit image of person captured on surveillance footage to search the Area Of Interest and view ranked trajectories	Submit image and prioritize trajectories than involve person meeting and walking with another person	Submit image and prioritize trajectories than involve entering a vehicle
PUC-15: Investigate recurring criminal behaviour	Submit image of person captured on surveillance footage to search the Area Of Interest and view ranked trajectories	Submit image and prioritize trajectories than involve suspicion of assault	Submit image and prioritize trajectories than involve suspicion of theft

2.4.2 System evaluation

This Scenario will be evaluated comparing the trajectory miner results with the real information that have been pre-defined in the staged in-place crimes recorded by the actors. The execution of the evaluation will consist into two phases: 1. The user builds up a query in the system and proceed to the comparison described above once the results are shown. 2. The user applies step by step slight modifications to the input set to verify how the system reacts to the changes and how the modifications affect the final result of the investigation. The feedback that will come from the experimentation of this feature will contribute to the final evaluation of the platform as a whole and will help to improve the product at a later time.

PRODUCT USE CASE	FUNCTIONAL REQUIREMENT	EVALUATION CRITERIA
PUC-33, PUC-34, PUC-35	FR-94	SURVANT UI shall provide a means of selecting the Area of Interest zone associated with an investigation and perform event-based searching of available surveillance footage in association with a target individual
PUC-33, PUC-34, PUC-35	FR-95	SURVANT UI shall provide a means of selecting the Area of Interest zone associated with an investigation and perform a combination of object-based and event searching of available surveillance footage. User shall be able to select and combine events to narrow their search.
PUC-32, PUC-33, PUC-34, PUC-35	FR-97	UI enables users to annotate key items of analysis
PUC-32, PUC-33, PUC-34	FR-100	UI presents a means of selecting the Area of Interest Zone and a target individual to initiate search. The API shall return the trajectories ranked according to the relevance to the target individual keeping into consideration the space-time relation for the movement of the individual and/or a specified starting (ending) point.
PUC-32, PUC-33, PUC-34	FR-101	UI presents a means of selecting the Area of Interest Zone, a target individual and a target action to initiate search. The API shall return the trajectories ranked according to the relevance to the target individual keeping into consideration the space-time relation for the movement in an area refined according to the target action.
PUC-35	FR-102	UI presents a means of selecting the Area of Interest Zone, a set of target events and a target individual to initiate search. The API shall return the events ranked according to the relevance to the target individual keeping into consideration the space-time relation of events and the movement of individual.
PUC-35	FR-103	SURVANT UI shall provide a means of selecting a set of events

		associated with an Area of Interest zone in an investigation and rank the events in a space-time domain specific to a target action
PUC-32, PUC-33, PUC-34, PUC-35	FR-104	UI enables users to view investigation timeline

3 Conclusions

This document provided an overview of three dedicated Pilots defined by SURVANT end-users and data acquired for the testing purposes. The Pilot plans have been organised into separate stages and timed based on the status in content acquisition phase. SURVANT Pilots are representing key instruments to test the efficiency and usability of developed functionalities and gathering valuable feedback from end users for further enhancements of the system.

The critical point in planning of the SURVANT pilots is the strong involvement of the users in pilots preparation and evaluation phases. During the upcoming period, the focus of the work will be put on definition of the evaluation methodologies and metrics reflecting functional and non-functional requirements. Similarly, SURVANT partners involved in pilot testing will work on setting up dedicated evaluation framework and test-beds for smooth execution of the testing phase during the last year of the project. Updates from pilot deployment and evaluation phases will be reported in deliverables D5.4 Pilot installation and D5.5 Pilot evaluation and assessment.