ARESIBO

HORIZON 2020

D5.1 AR Data Interface V1

ARESIBO

Augmented Reality Enriched Situation awareness for Border security
ARESIBO – GA 833805

Deliverable Information

Deliverable Number: D5.1
Date of Issue: 26/03/2020
Document Reference: N/A
Version Number: 1.0

Work Package: #5

Nature of Deliverable:
Report

Dissemination Level of Deliverable:
Public

Author(s): Pranav Menon (UBI),
Keywords: Augmented reality, solution, wearables, data flow, components, integration, interface, interactions
Abstract: A public document with the technical specifications, the frameworks and the adopted methodology to achieve interoperability between AR interfaces.

Document History

Date	Version	Remarks
19.03.2020	**0.1**	**Draft Version (UBI)**
26.03.2020	**1.0**	**First Version (UBI)**

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List of Acronyms

Acronym	Meaning
ARESIBO	Augmented Reality Enriched Situation awareness for Border security
AR	Augmented Reality
C2	Command and Control
WP	Work Package
UxV	Unmanned Vehicle
NATO	The North Atlantic Treaty Organization
RADAR	Radio Detection and Ranging
UI	User Interface
POI	Point of Interest
AOI	Area of Interest
MQTT	Message Queuing Telemetry Transport
JSON	JavaScript Object Notation

1 Executive summary

ARESIBO system aims to provide the operational teams and tactical command and control level with accurate and comprehensive information. The research emphasizes improving communication between humans, AR devices and sensors. The research also aims to improve the situational awareness of operational teams by providing the important information and the threat analysis by processing the reports from previous missions.
AR devices are an integral part of the system and play an important role to achieve the objectives of the research. To enable the AR devices to communicate with the ARESIBO system there is a need to develop an interface between all the components. WP5 aims to achieve this. The objectives of the WP are the following:

- ⇒ Develop a common interface for all AR Devices
- ⇒ Develop the functionalities and tools for Field Officers, Tactical Commanders and C2
- ⇒ Develop AR tools to provide information based on the past and further optimize the future tasks
- ⇒ Implement User Training through serious gaming method

This document represents the deliverable D5.1 "*AR Data Interface V1"*, the initial version focuses on developing a deeper understanding on the flow of AR data and aligning with D4.1 "Data representation model V1". The end-user entities that are part of ARESIBO have provided their inputs to questionnaires. The format of the questionnaire is attached in the appendix A. The structure of the questionnaire is based on the end-user officer that interacts with the AR device. The input captures the perspective of end-user entities based on their experiences and use cases.
The information in the document is collected from the technical partners who will be working closely to enable the AR devices and services for the end-user officers. Ubimax is responsible for the AR application for Field Officers, VTT for Tactical Commanders and Airbus Defence and Space for C2 Operators.

2 Introduction

The ARESIBO system consists of multiple components and it requires these components to communicate with each other. The development of these is the responsibility of the partners in the consortium. The components that are relevant to this deliverable are wearables (AR devices) and solutions that interact with these wearables. According to the Grant Agreement, the field officers will be equipped with monocular smart glasses, tactical commanders with binocular smart glasses and C2 officers with binocular smart glasses and larger screens to visualize the missions. Each user has specific needs and applications regarding the information available in the ARESIBO system. The data between each user category should be communicated through a common platform. This platform should process multiple types of data from various devices and other ARESIBO components. Developing this platform is one of the core objectives of WP5. The main tasks under D5.1 are:

- ⇒ Define needs and requirements of various actors.
- ⇒ Establish a framework for data usage across different device platforms is developed.
- ⇒ Develop adaptors to different backend systems and data sources, data transformation tools and routines

The diagram below describes the data flow through AR components. The actions for end-user officers using AR devices are represented by the blue boxes. The ARESIBO component in red could be any component that is part of the system, this component can be directly or indirectly interacting with an AR device based on the use case.

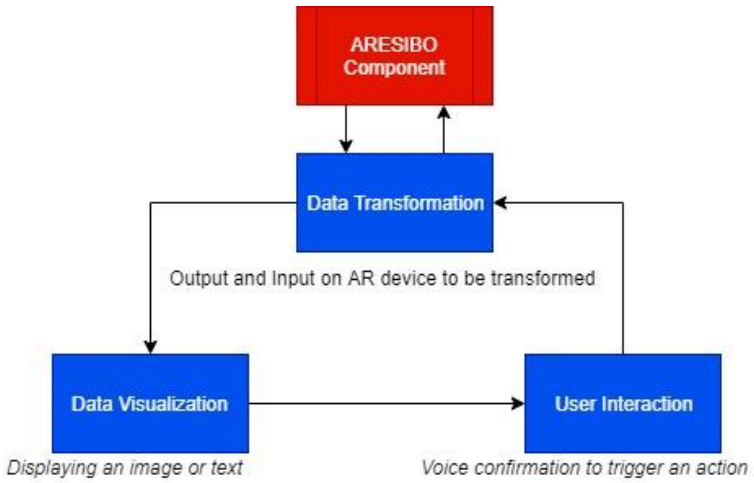

Figure 1: AR data flow

According to the main tasks under D5.1 mentioned above, the contents of the deliverable are separated into 3 chapters:

Data Visualization: The data to be visualized is defined based on the input provided by end-user entities to the technical partners. The need is further subdivided based on the requirement for Field Officer, Tactical Commanders and C2 Operators.

User Interaction: This chapter defines various methods of interaction that should be available for the end-user officer. These interactions are categorized as: Field Officer, Tactical Commanders and C2 Operators.

Data Transformation: The input and output to and from the AR device should be transformed and represented in a common format. This data is then available for other ARESIBO components for further processing.

3 Data Visualization

The idea of this chapter is to include the information acquired from the questionnaires that were answered by the end-user entities. The various categories of data to be visualized are based on the inputs acquired from these inputs.

Field Officers:

Following types of data should be available for Field Officers:

(1) Video from external devices such as UxVs or cameras, offline videos from various sources to get better situation awareness.
(2) Image: Still images from various sources and other stake holders such as Tactical Commander, C2, UxVs and external cameras.
(3) Sensor data: Information from various sensors such as motion sensor, radar information.
(4) NATO symbols: Standard symbols such as MilSTD2525C or NATO App6b
(5) Other symbols: Remaining symbols will be specified in v2 based on the experiences from the initial trial.
(6) Audio: Audio files containing information on the task
(7) Voice Stream: Real time stream between various sources such as Tactical Commander, C2 and other units.
(8) Video Stream: Real time stream between various sources such as Tactical Commander, C2 and other units.
(9) Maps: Standard maps with meta data which could be online or offline
(10) Location of various objects: Location information of various relevant objects.
(11) Textual Notes: Notes that contain instruction or information from previous similar incidents.
(12) Data from RADAR: External RADAR data that is relevant for the task.
(13) Data from Law enforcement registers: External data from registers that can support situational awareness of the User.

Tactical Commanders:

The data types that should be available for Tactical commanders are identical to the ones for Field Officers.

Furthermore, end-user entities defined 6 main data consumption or publishing modes for both Tactical Commanders and Field Officers:

(1) *C2 mode* where the user will have the 3D view of the 2D elementals represented by team members and targets or area/point of interest provided by C2.
(2) *Map mode* where the user will have the 3D view of the map with the elements from top view.
(3) *Recognition mode* where the user will have the possibly to establish and send to the C2 the positions of targets at a certain command.
(4) *Video streaming* where the user will provide automatically video streaming for C2 at a certain command.
(5) *Photo/video capturing* where the user will send automatically photos or video to C2 at a certain command.
(6) *Data logging model*, where data could be analyzed after the mission and/or used evidence for illegal activities.

C2 Operator:
End-user entities defined the following data types additional to the ones mentioned under Field Officers:

(1) 3D Maps: elevation models/ 3D urban models
(2) Live 3D elements
(3) Send messages to Field officers: mission/target information
(4) Send commands to visualize video stream of a location
(5) Display messages (Notes/images/text) received from field officers and tactical commanders
(6) Display messages received from Decision Support Tool along with remote field commander data for remote collaboration

Furthermore, end-user entities defined additional data consumption or publishing modes for C2 Operator:

(1) *3D maps*: 3D digital models from aero photogrammetry or point clouds
(2) Live 3D elements for teams along with identified objects or targets (deep real-time image analysis and instant population of the map with identified objects)
(3) Interrogations of POI/AOI or targets with the automated video visualization of the place and tools for sending target and AOI positions to the field officers
(4) Data content received from the field officers and tactical commanders.
(5) Decision support based on deep learning
(6) Gather all unstructured data from all the sensor and provide only the relevant data (structured) to the C2
(7) Remote field officer's and tactical commander's data for remote collaboration

4 End-User Interaction

The idea of this chapter is to include various possible interactions that is available to the end-user officers to accept, acknowledge or deny an information or a task.

Field Officer:

Most preferable interaction concepts are:

Figure 2: Input by Voice

- Voice Commands: The interaction with an AR device can be carried out hands-free. Some AR devices operate based on speech recognition. The speech recognition can be defined based on the configuration of the solution. It can be configured to recognize different languages and commands based on user preferences.

Figure 3: Input by Gestures

- Gesture: The interaction by gestures can be used to carry out a function on a user interface through a gesture. The gesture and its function should be predefined on the applicable solution for the function to be carried out successfully. This interaction is mostly developed in combination with touch.

Figure 4: Input by Touch

- Touch: The interaction by touch is mostly associated with devices that contain touch screens or touch pads. Touch screens can be used to directly manipulate data on the user interface. Touch pads can be used to point to a part of the user interface, this can also be integrated with gestures.

Tactical commander:

- Voice commands
- Gestures
- Smart phone touch screen

C2 operator:

- Voice command
- Gestures: With Mixed Reality devices such as HoloLens 2, the operator can select data, enter text with the assistance of a virtual keyboard, although the push buttons and the UI is similar to a generic C2.

5 Selected AR-Devices

Based on end-user entities' requirements from the questionnaire, environmental requirement (e.g. using devices in harsh conditions) and current state-of-the-art of devices, following devices has been preliminary selected. The final selection will be after the first user test.
The first proposal of the end-user officers AR-Devices are the following:

- Field officer – Realwear HMT-1 (See **Figure 5**Figure 5**)**
- Tactical commander – iPad Pro (See **Error! Reference source not found.**)
- C2 Operator – Microsoft HoloLens 2 (See **Error! Reference source not found.**)

Realwear HMT-1

Figure 5: Realwear HMT-1

HMT-1 is a rugged device optimized for heavy industry and outdoor environments. It can be easily mounted and can be used in combination with own glasses or helmet. It is a good option when moving between different temperature zones that include a frozen zone of -20 degrees Celsius. The battery can last up to 8 hours in use. The technical specification can be found on Table 1.

Table 1: Realwear HMT-1 Datasheet

Name	RealwearHMT-1
OS	Android 8.0
CPU	2GH
RAM	2 GB
Internal Storage	16 GB
Wifi	802.11a/b/g/n/ac, Ht20/40 (2.4/5GHz)
Display	854 x 480px
Camera	1080p;30fps Auto Focus
Audio	4 Digital mini microphones
Internal Battery	3240mAh
Weight	380g

iPad Pro

Figure 6: Fourth-generation 11" iPad Pro – Field Commander AR device

Technical details (see Table 2) on the Fourth-generation 11" iPad Pro upon which the ARESIBO Field Commander will use:

Table 2: iPad Pro Datasheet

Name	iPad Pro
Developer	Apple Inc.
Manufacturer	Foxconn (on contract)
Product family	iPad
Type	Tablet computer
Release date	:[show]

Discontinued	June 5, 2017 (12.9-inch 1G and 9.7-inch) October 30, 2018 (12.9 inch 2G) March 18, 2019 (10.5-inch 2G)
Operating system	iOS (2015–2019) iPadOS (2019–present)
System-on-chip used	Chips used[show]
CPU	CPU[show]
Memory	Memory[show]
Storage	32, 64, 128, 256, 512 GB or 1 TB[3] flash memory
Display	11-inch: 2388×1668 px (264 PPI) (IPS Panel), 11 in diagonal, 1.43:1[3][4]
Graphics	12-core PowerVR Series 7XT[5]
Sound	Four speakers, adjusting sound to device orientation
Input	Multi-touch screen, headset controls and ambient light sensors, 3-axis accelerometer, 3-axis gyroscope, digital compass, five microphones, Bosch Sensortec BMP280 barometer
Camera	[3]4K 11-inch: 7 megapixels 1080p front-facing TrueDepth and 12 megapixels 4K rear-facing, Digital Image Stabilization[3]
Connectivity	Wi-Fi and Wi-Fi + Cellular: Wi-Fi 802.11 a/b/g/n/ac; dual channel (2.4 GHz and 5 GHz); HT80 with MIMO[3] Bluetooth 4.2[3] Wi-Fi + Cellular: GPS & GLONASS[3] GSM UMTS/HSDPA 850, 900, 1700, 1900, 2100 MHz[3] GSM/EDGE 850, 900, 1800, 1900 MHz[3] CDMA CDMA/EV-DO Rev. A and B. 800, 1900 MHz[3] 12.9-inch Wi-Fi + Cellular: LTE Multiple bands 1, 2, 3, 4, 5, 7, 8, 13, 17, 18, 19, 20, 25, 26, 28, 29 and TD-LTE 38, 39, 40, 41[3]
Power	Built-in rechargeable lithium-ion battery[show]
Online services	App Store, Apple Music, iTunes Store, iBookstore, iCloud, Game Center
Dimensions	11-inch: 247.6 mm (9.75 in) (h) 178.5 mm (7.03 in) (w) 5.9 mm (0.23 in) (d)
Mass	11-inch WiFi and WiFi + Cellular: 468 g (1.032 lb)
Related articles	Apple Pencil, Apple A9X, Apple A10X, Apple A12X Bionic

Microsoft HoloLens 2

Figure 7: Hololens 2 – C2 Operators AR device

Technical details (see Table 4) on the latest release of Microsoft Hololens 2 upon which the ARESIBO C2 operator will use:

Table 3: Microsoft HoloLens 2 Datasheet

Name	Microsoft Hololens 2
Display	
Optics	See-through holographic lenses
Resolution	2k 3:2 light engines
Holographic density	>2.5k radiants (light points per radian)
Eye-based rendering	Display optimization for 3D eye position
Sensors	
Head tracking	4 visible light cameras
Eye tracking	2 IR cameras
Depth	1-MP time-of-flight (ToF) depth sensor
IMU	Accelerometer, gyroscope, magnetometer
Camera	8-MP stills, 1080p30 video
Audio and speech	
Microphone array	5 channels
Speakers	Built-in spatial sound
Human understanding	
Hand tracking	Two-handed fully articulated model, direct manipulation
Eye tracking	Real-time tracking

Voice	Command and control on-device; natural language with internet connectivity
Windows Hello	Enterprise-grade security with iris recognition
Environment understanding	
6DoF tracking	World-scale positional tracking
Spatial Mapping	Real-time environment mesh
Mixed Reality Capture	Mixed hologram and physical environment photos and videos
Compute and connectivity	
SoC	Qualcomm Snapdragon 850 Compute Platform
HPU	Second-generation custom-built holographic processing unit
Memory	4-GB LPDDR4x system DRAM
Storage	64-GB UFS 2.1
Wi-Fi	Wi-Fi: Wi-Fi 5 (802.11ac 2x2)
Bluetooth	5
USB	USB Type-C
Fit	
Single size, Fits over glasses	
Weight	566g
Software	
Windows Holographic Operating System	
Microsoft Edge	
Dynamics 365 Remote Assist	
Dynamics 365 Guides	
3D Viewer	
Power	
Battery life	2–3 hours of active use
Charging	USB-PD for fast charging
Cooling	Passive (no fans)
Contains lithium batteries	

6 Data Transformation

The idea of this chapter is to describe the method that transforms the data that has been interacted or represented by the end-user. This representation is transferred to the respective ARESIBO component to be further processed. The messages from the ARESIBO component should be encoded and decoded. Once the message is decoded, then each sub client (sub system for field officer, commander and C2 operator) is responsible for processing these data for further interactions. Similarly, the data from each end-user officer should be available to another officer. The following are some of the examples:

⇒ Send to Field Officers a “suspicious” location (coordinates, zone)
⇒ Textual information of Field Officer’s action
⇒ Video with additional information from Tactical Commander to Field Officer
⇒ Live video stream between Field Officer, Tactical Commander and C2.

The diagram below describes the common protocol that should be followed for data flow between various ARESIBO components.

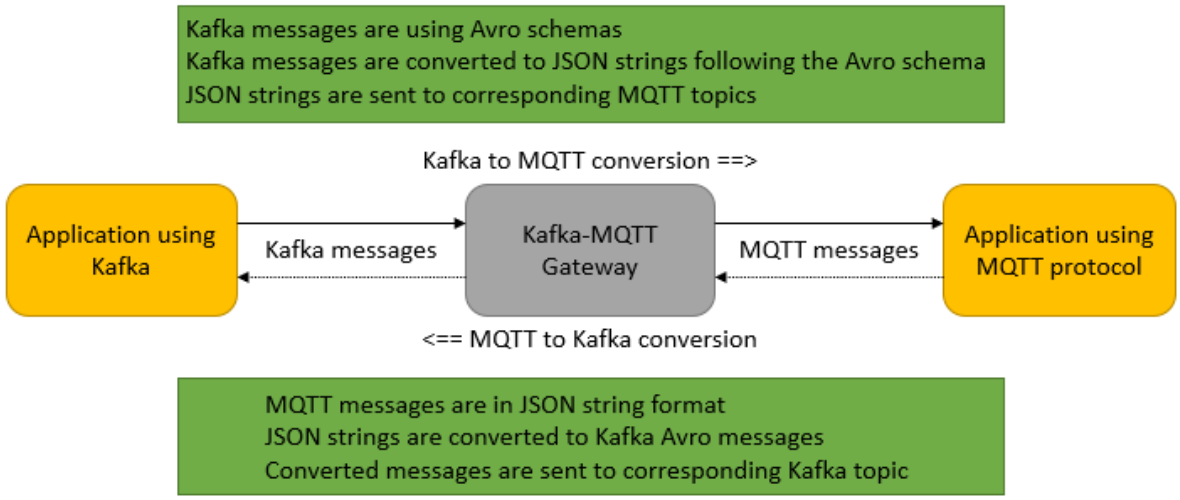

Figure 8: Kafka-MQTT Gateway

The data from an external application of a sub client will be integrated into a MQTT protocol, which should follow a JSON format. Then, the JSON strings are converted to Kafka Avro messages which are then sent to the corresponding Kafka topic (see Table 4). It is important to follow the protocol as ARESIBO system has set the Kafka protocol as a standard for communication. In order to connect with various components in the system, the transformation of data will be carried out with the help of a Kafka-MQTT Gateway. A Kafka topic may contain the event log for a component or multiple components. This gateway should be also developed in order to receive data from an ARESIBO component to an external application of a sub client. In this case, the Kafka messages that use Avro schemas will be converted to JSON strings and then it will be send to the corresponding MQTT topics.

Table 4. The first version of Kafka AVRO schema to deliver information between AR system

AVRO Schema	JSON with dummy data

{
"name": "C2Data",
"type": "record",
"namespace": "aresibo.c2data",
"fields": [
{
"name": "senderID",
"type": "string"
},
{
"name": "messageType",
"type": "string"
},
{
"name": "dataObject",
"type": {
"name": "DataObject",
"type": "record",
"fields": [
{
"name": "message",
	{
	"senderID": "7s9nb61oja",
	"messageType": "27jvm428o0",
	"dataObject": {
	"message": "3hvn6m0iyq",
	"latitude": 3.2479936648525474,
	"longitude": 5.990319542837966,
	"altitude": -0.8553699660170633,
	"roll": -8.442415751184937,
	"pitch": -4.828593077111187,
	"yaw": 5.264374802467957,
	"streamURL": "bllzc3b3er"
	}
	}

```
        "type": "string"
       },
       {
        "name": "latitude",
        "type": "double"
       },
       {
        "name": "longitude",
        "type": "double"
       },
       {
        "name":"altitude",
        "type":"float"
       },
       {
        "name":"roll",
        "type":"float"
       },
       {
        "name":"pitch",
        "type":"float"
       },
       {
        "name":"yaw",
        "type":"float"
       },
       {
        "name": "streamURL",
        "type": "string"
       }
      ]
     }
    }
  ]
}
```


7 Data Model Analysis

This chapter will corelate the above-mentioned data that should be visualized based on data information available on D4.1, Data Representation Model. The data represented in the Data Model is transported through the ARESIBO system and it is displayed on the end-user officer's device.

From the requirements as mentioned under chapter 3, the end-user officers need further information that is relevant based on their situation. D4.1 (Data Representation Model V1) mentions various data that are relevant for the end-user officers based on their need and situations, below are some of the examples that correlate to the Data Visualization (9):

Table 5: VideoDetection structure

Field	Type	Length	Units	Description
timestamp	long		None	The timestamp of the detection in Zulu time format
sender_id	int	4	None	Vehicle identification

source	string	50	None	RTMP or RTSP url
width	int	4	None	Frame width in pixels size
height	int	4	None	Frame height in pixels size
latitude	double	4	None	Latitude of the vehicle (if provided)
longitude	double	4	None	Longitude of the vehicle (if provided)
target_class	string	10	None	Class type of the detected object
target_object_id	int	4	None	Unique object id per detection
target_confidence	float	4	None	The confidence score of the detection
target_im_analysed	string	50	None	Path on a local server with a snapshot of the 1st frame of the detection
bbox_top	int	4	None	This is the smallest pixel value of the box along the x axis
bbox_left	int	4	None	This is the smallest pixel value of the box along the y axis
bbox_width	int	4	None	The width of the box in pixels along the x-axis
bbox_height	int	4	None	The height of the box in pixels along the y-axis

Table 5 mentions that the following fields correlate to the data that can be captured based on the detection from a video resource that is available on the system:

⇒ target_class and target_id provides further information on the target such as the medium of transport used by the target along with an identification information

⇒ latitude and longitude of the medium identified can be obtained

Table 6: AlertType structure

Field	Type	Length	Units	Description
alert_id	int	4	None	alert identification
vehicle_id	int	4	None	vehicle identification
subsystem_id	byte	1	Enumerated	identifier associated with the subsystem for which status information is being reported. ENGINE = 0, MECHANICAL = 1, ELECTRICAL = 2, COMMS = 3, PROPULSION_ENERGY = 4, NAVIGATION = 5, PAYLOAD = 6, RECOVERY_SYSTEM = 7, ENVIRONMENTAL_CONTROL_SYSTEM = 8, VSM_STATUS = 9, VDT = 10, CDT = 11, RESERVED_1 = 12, RESERVED_2 = 13, RESERVED_3 = 14, RESERVED_4 = 15, RESERVED_5 = 16, RESERVED_6 = 17, RESERVED_7 = 18, RESERVED_8 = 19, VSM_SPECIFIC_1 = 20, VSM_SPECIFIC_2 = 21, VSM_SPECIFIC_3 = 22, VSM_SPECIFIC_4 = 23, VSM_SPECIFIC_5 = 24, VSM_SPECIFIC_6 = 25, VSM_SPECIFIC_7 = 26,

				VSM_SPECIFIC_8 = 27, VSM_SPECIFIC_9 = 28, VSM_SPECIFIC_10 = 29, VSM_SPECIFIC_11 = 30, VSM_SPECIFIC_12 = 31
alert	byte	1	Enumerated	alert is an AlertKindType which specifies the enumeration value for the type of non-normal subsystem condition for AlertType. ACKNOWLEDGEABLE = 0, ACKNOWLEDGEABLE_CLEARABLE = 1, CLEAR = 3, CLEARABLE = 4, FIXED_TIME = 5, NOT_CLEARABLE = 6
alert_end_time	double	8	s	alertEndTime is a TimeType which specifies the date and time value relative to the end of the alert for the subsystem alert for AlertType.
alert_group	byte	1	Enumerated	alertGroup is an AlertGroupType which specifies the enumeration value of the group category for the subsystem alert for AlertType AIR_COLLISION = 0, AV_PLATFORM = 1, ENGINEERING = 2, HAZARDOUS_AREA = 3, MAINTENANCE = 4, PAYLOAD = 5, RESTRICTED_AREAD = 6, SYSTEM = 7
alert_level	byte	1	Enumerated	alertLevel is an AlertLevelType which specifies the enumeration value indicating the alert level for the subsystem for AlertType. ADVISORY = 0, CAUTION = 1, CLEARED = 2, WARNING = 3
alert_notification	byte	1	Enumerated	alertNotification is a NotificationType which specifies the enumeration value indicating the reason for receiving the alert for AlertType. The notification will be in response to a specific request or as a result of subscription. SPECIAL_REQUEST = 0, SUBSCRIBED_TO_REQUEST = 1
alert_priority	UInt32	4	None	alertPriority is an OrderType which specifies the priority level of the AlertType
alert_start_time	double	8	s	alertStartTime is a TimeType which specifies the date and time value relative to the start of the alert for the subsystem alert for AlertType
alert_status	byte	1	Enumerated	alertStatus is an AlertStatusType which specifies the enumeration value indicating the status of posted alert information for the subsystem for AlertType. ALERT_ACTIVE = 0, ALERT_ACTIVE_ACKNOWLEDGED = 1
alert_text	string	80	None	alertText is a DescriptionType which specifies the text for describing the alert for AlertType
latitude	double	4	None	latitude of the alert
longitude	double	4	None	longitude of the alert
altitude	float	4	m	altitude of the alert

category	byte	1	Enumerated	category is used to indicate the source module that the alert was created from. INCIDENT = 0 (incident detection) SFE = 1 (sensor fusion engine) RISK = 2 (risk analysis module)

Table 6 mentions that the following fields correlate to data available on an alert in the system:

⇒ alert_level provides the end-user officer further information on the category type of the alert, such as if the alert is an advice, caution or warning

⇒ alert_text provides further information containing a short description on the alert

Table 7: Position2DType structure

Field	Type	Length	Units	Description
latitude	double	8	rad	Latitude value describing the current position of the involved entity in WGS84 coordinates format
longitude	double	8	rad	Longitude value describing the current position of the involved entity in WGS84 coordinates format

Table 7 mentions that the following fields correlate to the 2D position information on an entity:

⇒ latitude and longitude information provide the location of an incident of interest

Table 8: IPPacketVoice structure

Field	Type	Length	Units	Description
IP header		20-60	Bytes	The IPv4 header is variable in size due to the optional 14th field (options)
IP payload		0-65,535	Bytes	The IPv4 payload is variable. It is notable due to the MTU of the network being 1500 Bytes, any packet larger than that value will be fragmented into packets smaller than 1500 Bytes.

Table 8 mentions that the following fields correlate to the information that is necessary to stream the live video and voice of an end-user officer:

⇒ IP header and payload can be used to access the voice and video stream through the following IP protocol.

8 Conclusion and Future Work

This deliverable presents the first version of the AR Data Interface that will be applicable to the ARESIBO system. It provides an overview of the end-user entities' requirements and need for the availability of data that provides relevant information for improved situational awareness. It also includes various interactions on AR devices that should be developed for the end-user officer. Along with it, the protocol for data transformation that the AR service providers should follow is also defined. The information in this deliverable will act as a base for the technical partners to develop the demos that are planned for M14.
Version 2 of this deliverable will have additional information based on the feedback from the demos and implementation phase of ARESIO system.

9 Acknowledgment

Thanks to all the technical partners and end-user entities who have contributed the necessary information to complete this deliverable.

Annex A: Example of the end-user questionnaire

End-user organization: _____

- ☐ Land boarder
- ☐ Sea boarder

1 Field officer

What kind of data you want show during mission:

- ☐ Video (drone, external camera, …)
- ☐ Image
- ☐ Other sensors e.g. motion sensor
- ☐ Nato symbols
- ☐ Other symbols_____
- ☐ Audio
- ☐ Voice stream
- ☐ Video stream ‘
- ☐ Map
- ☐ Location of various objects
- ☐ Notes (text, image) on field
- ☐ Radar info
- ☐ Something else_____

Interaction with AR device

- ☐ Voice commands
- ☐ Gesture
- ☐ Smart watch / small keyboard
- ☐ Something else_____

What are typical equipment’s during mission e.g. helmet, radio?

What kind of information are you currently receiving/sending before/during/after the mission?

Typical duration of the mission?

What is typical goal of the mission?

2 Field commander

What kind of data you want show during mission:

- ☐ Video (drone, external camera, …)
- ☐ Image
- ☐ Other sensors e.g. motion sensor
- ☐ Nato symbols
- ☐ Other symbols_____
- ☐ Audio
- ☐ Voice stream
- ☐ Video stream ‘
- ☐ Map
- ☐ Location of various objects
- ☐ Notes (text, image) on field
- ☐ Radar info
- ☐ Something else_____

Interaction with AR device

- ☐ Voice commands
- ☐ Gesture
- ☐ Smart watch / small keyboard
- ☐ Something else_____

What are typical equipment’s during mission e.g. helmet, radio?

What kind of information are you currently receiving/sending before/during/after the mission?

Typical duration of the mission?

What is typical goal of the mission?

3 C2 operator

What kind of data you want show during mission:

- ☐ Video (drone, external camera, …)
- ☐ Image
- ☐ Other sensors e.g. motion sensor
- ☐ Nato symbols
- ☐ Other symbols_____
- ☐ Audio
- ☐ Voice stream
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Interaction with AR device

- ☐ Voice commands
- ☐ Gesture
- ☐ Smart watch / small keyboard
- ☐ Something else_____

What kind of information are you currently receiving/sending before/during/after the mission?

What is typical goal of the mission from C2 point of view?

FIELD OFFICERS/ COMMANDERS

UNIQUE PLATFORM/APP with integration of communications, AR guidance and tools to extend app capabilities:

1. SECURED AND REDUNDANT COM (voice communication and live video streaming for C2):
VoIP - LTE - SATELLITE

2. AR GUIDANCE - "HELP":
- simple arrow indicators (positioning: multi-constellations, dual-frequency and multipart resistance)
- estimated DISTANCE and TIME (different modes: pedestrian or vehicle)
- situational MAP awareness
- text commands (3 cases)

3. TOOL - "FLEXIBILITY":
- connections to multi portal MR platforms for sending data to different agencies;
- text commands (sets of predefined commands, live TXT, voice recognition)
- add independent sensors (UAVs or pulse bracelets)

4. TYPE of DEVICES and AR MONOCULAR GLASSES
- mobile devices;
- monocular glasses with low weights (<80-100g).

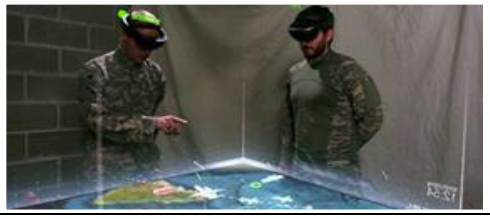
C2 MIXED REALITY PLATFORM

1. INTEGRATION with C2 PLATFORM (GIS – ESRI and HEXAGON)
- 3D map – including 3D digital models made with aerophotogrammetry or point clouds;
- live 3D elements for teams and identified objects or targets (deep real-time image analysis and instant population of the map with those identified objects);
- integration with the video management platform (selected video content based on geofencing alerts or interrogations);
- data content received from the field officers/commanders.
- decision support based on deep learning;
- gather all unstructured data from all the sensor sensors and provide only the relevant data (structured) to the C2

2. UX FEATURES for MR PLATFORM
- 3 AR segments referring to the video content received from geofencing alerts, video content from interrogations and data content from field officers;
- emphasis features in order to have a better perception for certain objects – team members and targets ("wave" motion or identification of the relation between the field officers and the data showed)

3. TRAINING
- possibility to save real scenarios (geodata) for being used in the training

See next page

Field officer and/commander	C2 Operator
	
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