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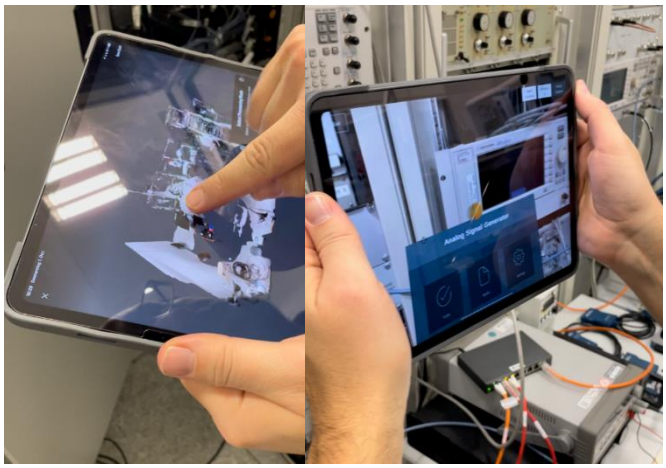
Augmented and Virtual Reality Support Tool for Ground Station Equipment and Telescopes, Executive Summary Report



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Record of Changes

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	First Released Version	1.0	2022-12-16

1 Introduction

1.1 Purpose

This document contains the Abstract of the “Augmented and Virtual Reality Support Tool for Ground Station Equipment and Telescopes” study.

1.2 Scope

This document contains the abstract summary of the activity.

1.3 Application

The aim of this document is to provide a quick overview about the activity.

2 Summary

To support the local engineers in maintaining the ground station equipment and telescopes using augmented and virtual reality, we carried out the following main activities:

- Identifying and collecting the main use cases
- Designing the architecture of the required system including the software and hardware components
- Implementing a prototype of the whole system including the client, service and web applications and procuring the needed devices as well
- Demonstrating several user scenarios on-site using the implemented applications.

Based on analyzing the business ideas collected through two workshops with the ESOC stakeholders, we derived several use cases. These use cases can be classified into two main categories:

- Interactive remote session: This includes several activities such as video and audio calls, interactive data exchange between the remote expert (RE) and the maintenance engineer (ME), and the ability of the RE to make a virtual tour in the environment of the ME.
- Overlaying dynamic digital data (AR objects) on physical assets: This includes several activities such as the identification of the assets based on QR code, overlying different kinds of data (device data, diagrams) based on the user requests, and presenting AR tasks to perform the maintenance procedure step by step.

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Then, we determined the main characteristic of the required system listed as follows:

- building AR objects and environments
- displaying and overlaying dynamic information
- highlighting and annotating
- remote support
- providing different kinds of data services.

After evaluating the user and system requirements, we proposed three complexity-based solutions to cover a wide-range of use cases while keeping time and cost in mind. The complexity factor is based on the components of the AVRGST system that must be developed. At the end, we were able to provide a solution which covers most of the core functionalities. The solution partly depends on COTS remote tools, and involves complex AR applications and services, and web-based interfaces for viewing 3D models and getting remote feedback. The local user of our system may use several devices such as iPad, Meta Quest 2 and HoloLens 2.

The developed AVRGST software provides different kinds of applications and services as depicted in the figure below: (1) client applications such as the AVRGST ME applications which should be installed on devices of the local users such as iPad and HoloLens 2, and (2) service and web applications that handle the data and enable the communication channel between RE and ME such as REST API and CMS. The AVRGST applications are described as follows:

- AVRGST ME applications: They provide different functionalities such as displaying 3D models, overlying information, interacting with AR objects, and establishing a communication channel
- AVRGST web applications: They involve several components:
  - Content editor: It is designed to allow users to enter data to the database and retrieve them through user-friendly web-based interface. Additionally, it has 3D Model Viewer to enable the virtual tour for example.
  - Communication application: It used to establish the audio and video communication between the RE and the ME and to allow sharing the camera feed
- AVRGST REST services: The REST API is developed to receive requests from the AVRGST ME applications and return the needed data in a JSON format. Additionally, the API is used by the CMS to manage the AVRGST database
- AVRGST MOM services: It is developed to allow 3D Model Viewer and AVRGST ME applications to exchange messages asynchronously
- Nextcloud for AVRGST: It provides a suite of client-server software for creating and using file hosting services.

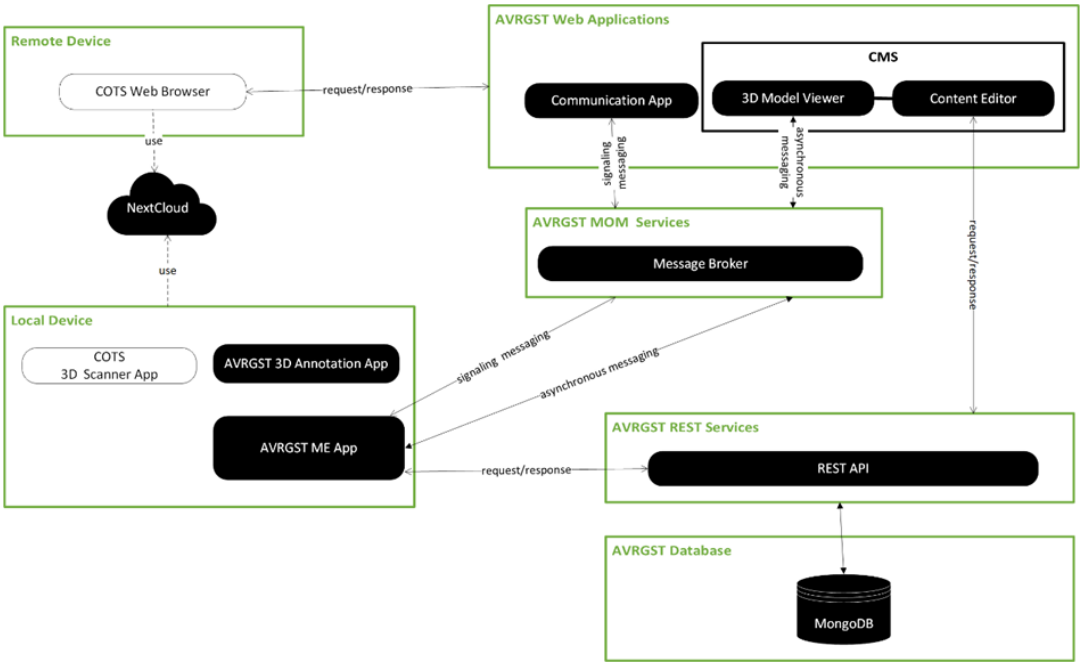

Figure 2-1 Architectural overview of the AVRGST applications

An overview of the AVRGST applications is depicted in the figure below. The left side of the figure presents the remote expert being supported with the CMS and the communication applications. The right side of the figure shows the maintenance engineer being supported with the ME applications. Both RE and ME applications are based on the AVRGST services.

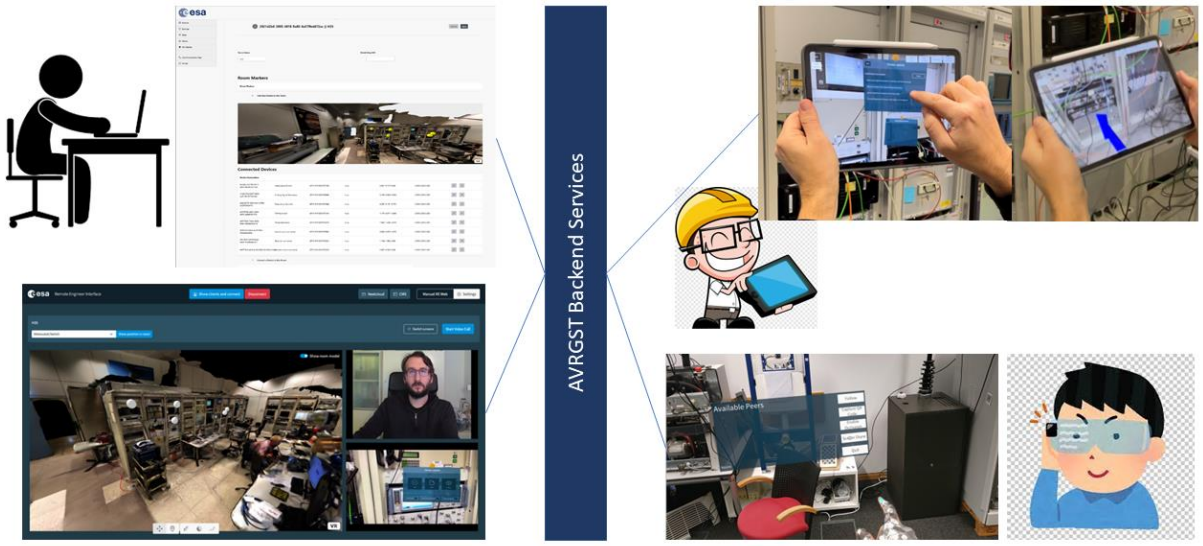

Figure 2-2 Illustrative overview of the AVRGST solutions