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|  | EUROPEAN COMMISSION  DIRECTORATE-GENERAL  INFORMATICS  Information systems Directorate |

European Commission

VR Cop Vision Document

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TABLE OF CONTENTS

* 1. Introduction 5

1.1. Purpose 5

1.2. Scope 5

1.3. Definitions, Acronyms, and Abbreviations 5

1.4. References 6

1.5. Overview 6

* 2. Positioning 6

2.1. Business Opportunity 6

2.2. Problem Statement 6

2.3. Information System Position Statement 7

2.4. New or updated Business Processes proposed for automation 8

* 3. Proposed Approach 8
* 4. Stakeholder and User Descriptions 8

4.1. Organisation goals 8

4.2. Stakeholders 9

4.3. User Environment 9

4.4. Key Stakeholder or User Needs 9

4.5. Alternatives 12

4.5.1. <Alternative A> 12

4.5.2. <Alternative B> 12

* 5. Information System Overview 12

5.1. Information System Perspective 12

5.2. Assumptions and Dependencies 12

5.3. Cost and Timing 12

5.4. Quality Ranges and Information System requirements 13

5.4.1. Availability 13

5.4.2. Usability 13

5.4.3. Maintainability 13

5.4.4. Applicable Standards 13

5.4.5. System Requirements 13

5.4.6. Performance Requirements 13

5.5. Licensing and Installation 14

* 6. Features 14
* 7. Planned ressources 16
* 8. Constraints 16

8.1. Security constraints 16

8.2. Data protection constraints 16

8.3. Other constraints 16

Document History

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| 1 | 01/10/2024 | Early stage, incomplete |  |
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# Introduction

The purpose of this document is to collect, analyse, and define high-level needs and features of the VR Cop work. Its will define the initial characteristics that the work will possess and be implemented throughout the year, presenting an overview of the system as well as specific data about the system’s objectives and features.

## Purpose

The final goal for this project is to implement the system into the academic program at Instituto de Polícia Judiciária e Ciências Criminais (IPJCC) in order to utilize recent available Virtual Reality technology in hopes of modernizing and improving the instruction of the institute’s alumni.

## Scope

This work is the final project for the Master’s degree in Computer Engineering and Media in Instituto Supoerior de Engenharia de Lisboa. The proposition for the project was discussed in collaboration with IPJCC.

## Definitions, Acronyms, and Abbreviations

| **Domain[[1]](#footnote-1)** | **Data object Name** | **Description (EN)** |
| --- | --- | --- |
|  | VR | Virtual Reality – A 3D experience utilizing a VR headset in order to create a simulated environment that immerses the user to a higher degree than traditional screen experiences. |
|  | VR Headset | A head-mounted device with two near-eye displays that resemble a pair of goggles which cover the user’s sight and present the simulation. |
|  | IPJCC | Instituto de Polícia Judiciária e Ciências Criminais, who are collaborating with the student in hopes of modernizing their academic process. (?) |
|  | Unity | Free-use game engine which is easy to learn and intuitive, which supports the creation of VR applications. |
|  | NPC | Non-playable character: refers to the civilian present in the simulation which is a completely virtual character with artificial behaviour. |
|  | LLM | Large Language Model is an artificial intelligence model that is trained on a very large amount of text or audio in order to process and understand human speech. |

## References

(a definir)

## Overview

The structure of the document is as follows:

* Position within the current state of the marked that the system belongs to (VR industry).
* Suggestion on the approach to take in order to solve the problem in the industry.
* Definition of the parties interested in or collaborating with the project, along with their goals.
* A final section with a high-level definition of the System Overview and functionalities that will be implemented at later stages of the work.

# Positioning

## Business Opportunity

While there is no defined business agreement currently, this project could eventually be implemented into the process of teaching.

## Problem Statement

|  |  |
| --- | --- |
| The problem of | The current, traditional method of teaching |
| Affects | The IPJCC and other organizations involved in the training of alumni in real-world scenarios |
| the impact of which is | The scalability and efficiency of the practice of these scenarios. |
| a successful solution would be | Implementing a robust, scalable and modular VR system to diminish costs and increase efficiency. |

## Information System Position Statement

(a definir)

|  |  |
| --- | --- |
| For |  |
| Who |  |
| The (*Information System name*) |  |
| That |  |
| Has a security classification |  |
| Unlike |  |
| Our Information System |  |

## New or updated Business Processes proposed for automation

(a definir)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Domain[[2]](#footnote-4)** | **ID** | **Name** | **Description (EN)** | **Description (FR)** |
| FINANCIAL | 1 | **General ledger** |  |  |
| FINANCIAL | 1.1 | *Payment* | The operational payment process flow covers the payment process starting from receipt of cost statement, invoice or request for payment or other supporting document, until payment execution |  |
| FINANCIAL | 1.2 | *Recovery Order* | The operational recovery order process flow covers the receivables process starting form forecast of revenue, creation of recovery order until effective recovery of the principal amount and interests for late payment if applicable |  |

# Proposed Approach

(a discutir)

The proposed approach is a Unity application which, similarly to the project implemented as the final work for the undergraduate course of the student, pretends to simulate real-life scenarios involving the police officers who are being instructed at IPJCC.

The main objective in the scenarios will be to perform an intervention to a civilian vehicle and the subsequent verification of the conditions under which the conduction is being carried out. Specifically, the intervention will be to detain an already identified civilian.

The simulation will start with the user sitting inside or standing beside their service vehicle, equipped with the necessary equipment to carry out the intervention. As the user approaches the civilian vehicle, the civilian will act independently to the user, as it possesses its own unpredictable behaviour. The user’s task is to control the situation according to the actions of the civilian in order to complete the arrest successfully.

The possibility of adding varied scenarios to the simulation will be explored, as it is crucial to maximize the different situations in which the user might find themselves in real life.

Some aspects that will be discussed for the proposed system include the training of a Large Language Model (LLM) with recordings of the voices of collaborators at IPJCC to improve the current voice recognition feature, as well as a way to record, save and replay played scenarios in order to review them. The system could also allow the possibility of more than one player, which would enhance the experience by bringing teamwork into the scenarios.

# Stakeholder and User Descriptions

The stakeholders involved in the Requirements modelling process are the directors at IPJCC and the trainees that will eventually use the proposed system in their training process.

## Organisation goals

(a discutir)

## Stakeholders

(a definir)

|  |
| --- |
| **Name** |
| **Description** |
| **Responsibilities** |
| **Success Criteria** |

## User Environment

The user population will be IPJCC trainees, who will be using the system, and their instructors who will be monitoring and reviewing their performance.

In order to complete the task only one user is required, unless the system ends up allowing multiple users simultaneously. One or more instructors could oversee the simulation in real time, or in a later playback of a recording of the simulation.

The time to complete a task is variable as the parameters of the simulation can be altered to provide different situations. (a discutir)

The platform of the application, as stated before, is Unity Engine which is an intuitive software chosen due to the student’s familiarity with it. Other engines like Godot or Unreal Engine could support the system, but the chosen engine is ultimately Unity.

## Key Stakeholder or User Needs

* The training of specific detention scenarios carried out in IPJCC needs resources in order to be carried out. Currently, this requires several people apart from the trainees to act as civilians, and also material resources such as police equipment and vehicles are needed to set up the scenario. Additionally, the space required is relatively large, as several vehicles need to fit and the users might need to walk or run long distances. This system would require no more than a large empty space with a computer and a VR headset. Only the trainees and the instructors need to be present, as there is no need for someone to act as a civilian.
* The materials and space required are currently physical props or real equipment and they are more expensive and require more maintenance than the proposed VR solution, which would require a VR headset and a computer as the only material.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Need** | **Priority** | **Concerns** | **Current Solution** | **Proposed Solutions** |
| Physical vehicles or prop vehicles | high | Maintenance, storage, space required and price | Physical prop | Virtual component |
| Physical tools, weapons or other equipment | high | Maintenance and price | Physical props | Virtual component |
| Space to carry out scenario | high | Space required | Large empty space that fits vehicles. | Relatively spacious empty room |
| Human civilian actor | high | Requires an extra person for the scenario | Person | Virtual component |

## Alternatives

(a discutir)

# Information System Overview

## Information System Perspective

The proposed system is mostly self-contained, excluding the voice-recognition part which currently uses Wit.ai, a voice recognition software developed by Meta.

## Assumptions and Dependencies

(a definir)

## Cost and Timing

Since the system requires a VR-ready computer and a VR headset, the cost of the system is the sum of the prices of each of the components. A VR-ready computer can be purchased for around 500€, and the Meta Quest 3, which is an ideal VR headset, costs 480€. The total cost would be just under 1000€.

## Quality Ranges and Information System requirements

(a discutir)

### Availability

The system is available at any time.

### Usability

The system will not possess any maintenance assistance apart from the developer, who is in direct contact with the client.

### Maintainability

The system will be easily maintainable, only needing disinfection of the VR headset and controllers every once in a while.

### Applicable Standards

(a discutir)

### System Requirements

Operative System: Windows, MacOS, Linux

Computer requirements:

* Graphics Card: NVIDIA GTX 1060 or AMD Radeon RX 480 graphics card with 6GB of dedicated memory

### Performance Requirements

The system requires the simulation to run smoothly and with minimal delay, as real-time interactions are crucial to a VR simulation.

## Licensing and Installation

The installation of this system consists of a single step, which requires the download and execution of the deployed Unity application.

# Features

|  |  |  |  |
| --- | --- | --- | --- |
| **Need** | **Priority** | **Features** | **Planned release** |
| A VR environment suited for the proposed scenarios | high | One or more modelled 3D virtual environments contained within a square no more than 40x40m in size, complete with 3D interactable objects | Final release |
| An assortment of virtual tools for the user. | high | Manually modelled objects or downloaded assets to serve as interactable virtual tools for the user. | Final release |
| A working locomotion system to move around the environment | high | Use of a toolkit for Unity to implement VR Headset control support. | Final release |
| An NPC to replace the person who acts as a civilian | high | Implementation of a state machine that makes the NPC’s behaviour organic and unpredictable, and the user can interact with it. | Already implemented |
| A way to utilize the user’s voice input to interact with the NPC | high | A voice-recognition system using either already defined commands or normal speech by training a LLM. | Final release |
| A way to save and view played scenarios | optional | A save / replay feature that allows the footage to be discussed and reviewed by instructors, or used as an example for instruction. | Final release |
| A way to change the parameters of a simulation | high | A menu that allows users to edit all the parameters of the scenario in order to play different situations in varied environments. | Final release |

# Planned ressources

The resources needed to implement this system are limited to the VR Headset (which was decided to be the Meta Quest 3).

# Constraints

## Security constraints

(a definir)

## Data protection constraints

(a discutir)

## Other constraints

(a discutir)

1. Domains momentarily apply to one of the following corporate domains : Document management, Other External (policy related), Financial, Human Resources, Other Internal (administration), Methodology (RUP), Portal (internal), Resource planning / reporting, Security, Data Warehouse. [↑](#footnote-ref-1)
2. Domains momentarily apply to one of the following corporate domains : Document management, Other External (policy related), Financial, Human Resources, Other Internal (administration), Methodology (RUP), Portal (internal), Resource planning / reporting, Security, Data Warehouse. [↑](#footnote-ref-4)