deti universidade de aveiro
departamento de electrónica, telecomunicações e informática

Tracking App

Inception Phase

Group 13

Supervisors:
Professor Osvaldo Pacheco
Professor Gonçalo Carnaz

Our team

David Amorim
DevOps

Francisco Albergaria
Product Owner

Francisca Silva
Team Manager

Gabriel Santos
Quality Assurance
(Product Tester)

Guilherme Amaral
DBA

João Gaspar
Architect

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Context

Why this idea?

Context

Background

Law enforcement uses surveillance systems to monitor urban areas and aid investigations. With dozens or even hundreds of cameras in cities, video analysis remains mostly manual, making it slow and inefficient.

Technological Gap

Traditional surveillance systems lack advanced features such as automatic weapon detection and continuous suspect tracking across multiple cameras, limiting their effectiveness in investigations.

10196

Number of complaints in Coimbra (2023)

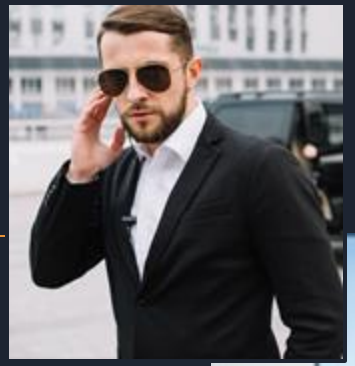
-0,7%

Percentage of criminality in Coimbra from 2022 to 2023

315

Violent crimes reported in Coimbra (2023)

Ref: https://www.noticiasdecoimbra.pt/extorsao-roubo-e-rapto-subiram-em-2023-coimbra-apresenta-uma-ligeira-diminuicao-da-criminalidade-geral/
https://criminalidadeportugal.com/RASI_2023.pdf



02

Problem

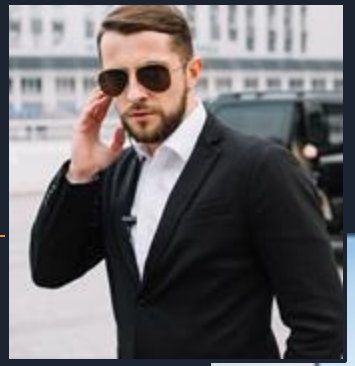
How will our app help the world?

Problem

Nowadays, in the context of a crime investigation process, police officers may have to watch thousands of hours of CCTV footage to track a potential suspect, for example a person holding a weapon in the middle of a crowd. This brings several problems and obstacles:

- Very time-consuming
- Performance diminishes with the officer's level of tiredness
- Too many cameras!

A police officer may have to watch hundreds of cameras simultaneously. This is a difficult task and in the case of a crime, it is very important to quickly track and detain the suspect.



03

Goals

What do we expect of our software?

Goals

Weapon Detection

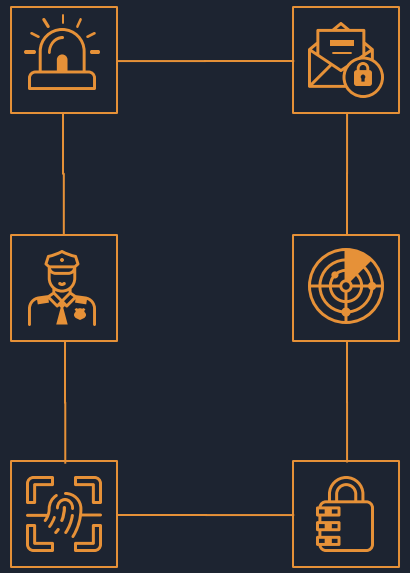
Catch and identify weapons on several frames, marking the suspect holding them

Suspect Highlighting

Highlight marked suspects

Attributes retrieval

Characterize marked suspects, identifying and saving their main attributes



Suspect Tracking

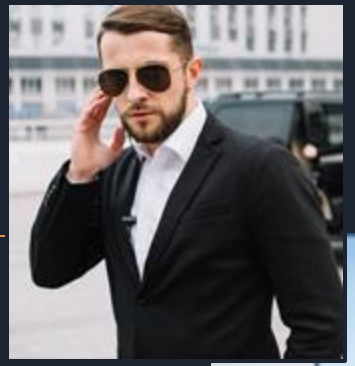
Track the marked suspects along several CCTV cameras

Movement Mapping

Map the suspects movement over the cameras onto a map

Real-time and video tracking

Allow tracking suspects both in real-time or over uploaded videos



04

Tasks

Main features to develop and their risks

Tasks

Plan Architecture

Being a complex project, it requires more attention

Study Algorithms

We are currently studying the capabilities of YOLO for object identification

Train Algorithms

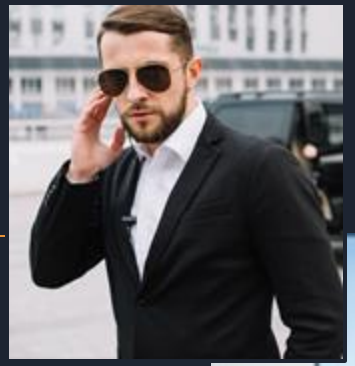
It takes lots of time to train the algorithms, especially with big datasets, to ensure good results

Develop Tracking

There is a need to ensure good performance while tracking suspects along several cameras

Real-time Analysis

Real-time analysis of several camera feeds can become a challenge



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Expected Results

What do we hope to achieve?

Expected result

Faster Investigations

Automating suspect tracking across multiple cameras will significantly reduce the time spent analyzing surveillance footage.

Enhanced Crime Detection

The system will automatically detect weapons and suspicious activities, assisting law enforcement in preventing crimes.

Optimized Resources

Police officers will be able to focus on decision-making rather than spending hours manually reviewing videos.

Secure & Controlled Access

Ensuring that only authorized users can access and manage surveillance data, reducing risks of misuse.

Data-Driven Insights

Providing tracking logs and movement maps to facilitate evidence collection and improve case resolution rates.

Expected result

Not a 100% bulletproof detection and tracking model, but with a reasonably amount of accuracy that might help a crime investigation.

Inspiration & Previous Research

This project draws inspiration from the master's thesis by **Pedro Monteiro**:

"Real-Time Weapon Detection in Surveillance Video Footages"
(Universidade de Aveiro, 2024).

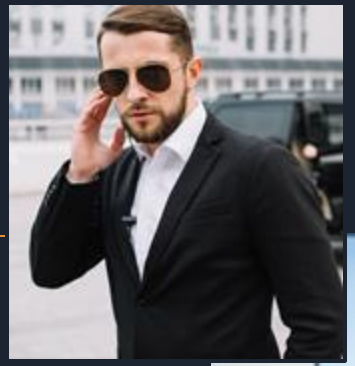
His research developed SafeGuard, a system that detects weapons in real-time using YOLOv5.

How Our Project Expands This Work

Beyond Weapon Detection: Instead of only identifying weapons, our system tracks suspects across multiple cameras.

Improved Investigation Process: We **log suspect movements** and allow users to **mark and follow individuals** in video footage.

Enhanced Security and Control: The system includes user authentication and access control.



06

Organization

Our team and work ethic

Communication

Github

To keep track of tasks and documentation, along with the repositories for the project

Whatsapp

For voting and last hour changes that need to be quickly reported to the team

Communication

Discord

For quick chats, meetings and organizing some relevant information

Weekly Meetings

Weekly team meetings:
Mondays (Team only)
Thursdays at 12:00 with supervisors

Project Calendar

Week	Start Date	Due Date	Module	Task	Description	Assignees	Deliverables
1	2/11/2025	2/18/2025	Planning	Choose the project theme	Select a theme from the themes list and talk to the orientator (prof. Osvaldo Rocha Pacheco)	All the group members	M1: presentation of the lifecycle objectives and calendar for the project
				Study related work	Read the master's dissertation by Pedro Monteiro; Search for more information and tools		
2	2/18/2025	2/25/2025	Organizing	Project presentation	Identify the context, problem, goals and related work	Francisco Albergaria + Guilherme Amaral	
				Project calendar	Identify the tasks and assignments	Francisca Silva	
				Project website	Setup the documentation site and build it	David Amorim	
				Start project report		Francisco Albergaria + Guilherme Amaral	
				Figma prototype	Start figma prototype	Gabriel Vieira + João Gaspar	
3	2/25/2025	3/4/2025	Architecture	Plan project architecture		João Gaspar	M2: presentation of the lifecycle architecture; the milestone is achieved when the architecture has been validated.
				Define requirements + uses cases and personas	Functional and non-functional requirements	Guilherme Amaral	
				Figma prototype	End figma prototype	Gabriel Vieira + João Gaspar	
				Study YOLO Algorithms	Detection, Segmentation and Tracking	David Amorim	
				Diagrams		Francisco Albergaria	
				Github Project Backlog		Francisca Silva	
4	3/4/2025	3/11/2025	Setup	Setup for frontend implementation		Francisca Silva + Francisco Albergaria	
				Setup for backend implelentation		David Amorim	
				Define and Setup the database		Guilherme Amaral	
				Frontend - Cameras page	Cameras page	Gabriel Vieira + João Gaspar	
				Backend - Cameras page		David Amorim	
				Study Algorithms		All the group members	
				Project website - M2	Update the project website for the M2	David Amorim + Francisca Silva	
				Project presentation - M2	Update the presentation for the M2	All the group members	
5	3/11/2025	3/18/2025	Development Weapon detection + authentication	Implement an algorithm to identify weapons	Identify a weapon	David Amorim	M3: prototype; mid-term presentation with supervisors; peer evaluation.
				Train the algorithm for weapon identification		Gabriel Vieira	
				Frontend - Authentication pages	Implement an authentications system to limit access to cameras and data	João Gaspar + Francisco Albergaria	
				Backend - Authentication System		Francisca Silva + Guilherme Amaral	
				Update the report and documentation		All the group members	
6	3/18/2025	3/25/2025	Development Person Segmantation + Account management	Implement an algorithm for person segmentation	Identify a suspect and highlight the precise outline	Francisca Silva	
				Backend - User selection of a person		David Amorim	
				Frontend - CRUD for account (Admin) Page	Implement an account management system for admins	Francisco Albergaria + Guilherme Amaral	
				Backend - CRUD for accounts (Admin)		Gabriel Vieira + João Gaspar	
				Update the report and documentation		All the group members	
7	3/25/2025	4/1/2025	Development Characteristics of a person	Implement an algorithm for extract characteristics	Extract characteristics in people that allow re-identifying these people in different images.	David Amorim + Francisca Silva + João Gaspar	
				Frontend - Show Personal characteristics		Francisco Albergaria	
				Backend - Get Personal characteristics		Guilherme Amaral	
8	4/1/2025	4/8/2025		Database - Person characteristics		Guilherme Amaral	
				Test - Person characteristics		Gabriel Vieira	
				Update the report and documentation		All the group members	
				Project website - M3	Update the project website for the M3	David Amorim + Francisca Silva	
				Project presentation - M3	Update the presentation for the M3	All the group members	

Project Calendar

9	4/8/2025	4/15/2025	Development Reidentification	Implement an algorithm for reidentification	Reidentification of people in images collected by different cameras.	David Amorim + Francisca Silva + João Gaspar	M4: project presentation; all functionality has been developed!
				Database - Storing and processing data		Guilherme Amaral	
				Backend - Show the camera where the person is		Francisco Albergaria	
				Test - Person reidentification		Gabriel Vieira	
				Update the report and documentation		All the group members	
10	4/15/2025	4/22/2025	Development Tracking	Backend - Get the places where the person was	Map the person's movement on a map, keeping the person's marking in the different images collected	Francisco Albergaria + João Gaspar	
				Frontend - Map with the places where the person was		David Amorim + Francisca Silva	
11	4/22/2025	4/29/2025		Database - Processing data		Guilherme Amaral	
				Test - Person tracking		Gabriel Vieira	
				Update the report and documentation		All the group members	
12	4/29/2025	5/6/2025	Development Extra Features	Implementation of the extra features - Frontend		TBD	
				Implementation of the extra features - Backend		TBD	
				Test - Extra Features		Gabriel Vieira	
				Update the report and documentation		All the group members	
13	5/6/2025	5/13/2025	Development Final improvements	Final Improvements - Frontend		TBD	
				Final Improvements - Backend		TBD	
				Frontend - About us page		Francisco Albergaria	
				Frontend - Clean Code		TBD	
				Backend - Clean Code		Guilherme Amaral	
				Test - Final Improvements		Gabriel Vieira	
				Update the report and documentation		All the group members	
14	5/13/2025	5/20/2025	Evaluate system performance	Metric to evaluate: detection	Evaluate system performance using metrics	Gabriel Vieira	
				Metric to evaluate: segmentation		Francisco Albergaria	
				Metric to evaluate: tracking		João Gaspar	
				Metric to evaluate: other(s)		David Amorim + Francisca Silva + Guilherme Amaral	
				Update the report and documentation		All the group members	
15	5/20/2025	5/27/2025	Demo + poster for students@deti & video	Demo	Promove our work	Gabriel Vieira + João Gaspar	
				Poster		David Amorim + Francisca Silva	
				Video		Francisco Albergaria + Guilherme Amaral	
				Make the project communication		Francisco Albergaria + Guilherme Amaral	
				Update the report and documentation		All the group members	
16	5/27/2025	6/3/2025	Final presentation	Final project presentation	Update the presentation for the M4	All the group members	
				Project website - M4	Update the project website for the M4	David Amorim + Francisca Silva	
				Final project deployment		João Gaspar	
-------	6/3/2025	-------	Students@Deti	Present our work		All the group members	Students@Deti

Thank you!