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Filière : Smart information and communication technologies engineering

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Développement d'une application de vérification des standards de sécurité des opérateurs

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Abstract

As part of the development of its industry 4.0 smart factory project, the Research and Development Laboratory of Advanced Numerical Engineering (LINA) at the Superior School of Textile and Apparel (ESITH) wishes to implement an application for verifying the adherence to security standards by operators in the factory (e.g., wearing gloves, glasses, aprons, etc.) and monitoring their presence in the factory by analyzing images captured by the cameras. The application will utilize open-source tools to recognize the safety equipment worn by operators.

This report mainly focuses on presenting the architecture of the application, with a particular emphasis on the development of the machine learning models that will handle image recognition and computer vision. Subsequently, we will test this application in the laboratory's factory using video data from the cameras.

Key words : Monitoring, Computer vision, Image recognition, …

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Chapter 1

General Project Context

Introduction

In this chapter, we aim to provide a comprehensive understanding of the project and internship experience by establishing the context. We begin with an introduction to LINA, the host organization, followed by an in-depth exploration of the project. This includes a detailed description of the project's scope and an outline of the various tasks accomplished during the internship.

1.1. Presentation of LINA :

Figure 1.1 : LINA logo

LINA (Laboratoire en Ingénierie Numérique Avancée) or the Laboratory of Advanced Numerical Engineering is a Research & Development laboratory founded in the Superior School of Textile and Apparel (ESITH) in Casablanca, Morocco with the mission to promote applied research in the domain of advanced numerics, develop students skills in advanced numerics research and contribute to the evolution of study programs.

It focuses mainly on the digital transformation of 4.0 industry, the development of smart captors and textile (IoT) and on digital factories/digital twins.

1.2. Presentation of the project :

This project aims to develop an application that uses computer vision techniques to monitor and enforce safety standards among operators in industrial settings. By analyzing real-time video footage captured by cameras positioned strategically in the factory, the application will detect and verify if operators are wearing essential safety equipment such as gloves, goggles, aprons, badges, and other prescribed items according to their role in the factory while also monitoring their presence in the factory (Arrival, breaks,…).

Key components of the application include leveraging open-source tools and libraries specialized in image recognition and object detection. These tools will enable the system to accurately identify and classify safety gear worn by operators. The application will employ machine learning algorithms trained on datasets to improve the accuracy and reliability of detection.

The ultimate goal is to enhance workplace safety by automating the monitoring process, ensuring compliance with safety protocols without relying solely on manual inspections. This approach not only improves operational efficiency but also reduces the risk of accidents and promotes a safer working environment for all personnel involved.

1.3. Introduction to the Research & Development center at ESITH:

We began our internship with a visit to the Research & Development Department at ESITH on Monday, July 1st, 2024. Professor Samir TETOUANI guided me (Khadija GOUAGHOU), along with my colleague Mohamed Elaouan and our supervisor, Dr. Omar Souissi, through the factory where we will be testing our application at the conclusion of our two-month internship at LINA. Accompanied by ESITH staff, Professor TETOUANI showcased the work environment and demonstrated the safety gear operators wear when operating specific machinery.

Figure 1.2 : Fabric cutting machine that requires the use of iron gloves

Figure 1.3 : Iron cut-proof gloves