



Licenciatura em Engenharia Informática e de Computadores
Projeto e Seminário - Semestre de verão 2022/2023
Project Proposal

SensiFlow - Intelligent camera system for people detection and flow control

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1 Introduction and State of the Art

Person/Object detection technology is crucial in applications that require automated analysis of visual data. With the improvements of deep learning models, we can now train models that can accurately identify people and objects in a variety of settings, from crowded streets to poorly lit environments.

The state of the art technology for person/object detection stands on deep learning models such as Faster R-CNN (Region-based Convolutional Neural Network), YOLO (You Only Look Once), and SSD(Single-shot detector) paperswithcode, which use convolutional neural networks to extract high-level features from images and then predict the class and location of objects within them. Azevedo (2022)

That's where SensiFlow operates - our project that uses person and object detection technology to calculate metrics such as occupancy rate of people in an area. By leveraging the latest deep learning-based approaches, SensiFlow can detect people and objects within a given space, and provide real-time occupancy data and insights. This technology has become increasingly important in various domains, including retail, hospitals and health care, and transportation, where understanding the flow and density of people can help improve efficiency, safety, and customer satisfaction.

2 Objectives

2.1 Functional requirements:

1. Person detection.
2. People counting in a given space.
3. Statistical analysis, using the received data, e.g. number of people at a given moment and time interval.
4. Secure transmission of images from an Arduino-controlled camera.
5. Development of an API to provide the data.
6. Creation of a dashboard for data visualization.

2.2 Optional requirements:

1. Ability to obtain statistics for a pre-recorded video.
2. Recognize the proximity of a person to an object.
3. Ability to configure zones in a space (restricted or unrestricted).
4. Implement a solution for the case of camera overlap.

3 Justification

The main objective of this project is the design and architecture of the application, in which artificial intelligence tools will be used so that the system can fulfill the defined objectives. Although the project involves the use of artificial intelligence and Computer Vision techniques, the main focus will be on creating a complete and scalable system, integrating all components in a harmonious way. Throughout the development process, issues of performance, security, and scalability will be considered to ensure that the system meets the established requirements.

4 Scope

The functionality of the project and the resulting web app is suitable for any space that usually has a large gathering of people, such as restaurants or auditoriums, facilitating their management.

5 Approach and Delivery

5.1 Approach

We propose to create a responsive WebApp dashboard that can be used on different devices. It will obtain resources through a Web API that accesses a postgres database. The database will also be used to store data from an image processor that connects to an RTSP (Real Time Streaming Protocol) server. The image processor receives frames from an Arduino connected to a camera and processes them accordingly.

The image processor will be developed in Python and YOLOv5 ultralytics (2022) will be used for the identification of people and objects.

The dashboard will be developed with Spring in Kotlin. It provides resources for the development of high-performance and scalable applications, as well as having a wide range of extensions that facilitate the creation of web applications.

The frontend will be created with React, a widely used JavaScript library for creating user interfaces. With its extensive documentation and large developer community, React is a solid and reliable option for creating a responsive and attractive user interface.

5.2 Delivery

Once the project is completed, the resulting outcome will be the delivery of an application that meets the announced requirements, as well as the delivery of a final report that documents all the necessary information for understanding the project. The report will include the following:

1. Overview of the project and its objectives
2. Description of the technologies used and their rationale
3. Detailed description of the system architecture, including diagrams and explanations of each component
4. Overview of the development process, including any challenges faced and their resolution

5. Description of the testing process and results
6. Discussion of future improvements and potential future developments
7. Conclusion and summary of the project

6 Constraints and Assumptions

The project delivery timelines and stages must be met. The code must include testing and documentation. All optional points will be developed if there are no delays in the mandatory requirements.

7 Risks

Considering that the project will use technologies that were not learned during the course, it is necessary to allocate some time for their learning. The resolution of problems associated with these technologies will also have to be taken into account.

8 Attachments

Figure 1 illustrates the general system architecture.

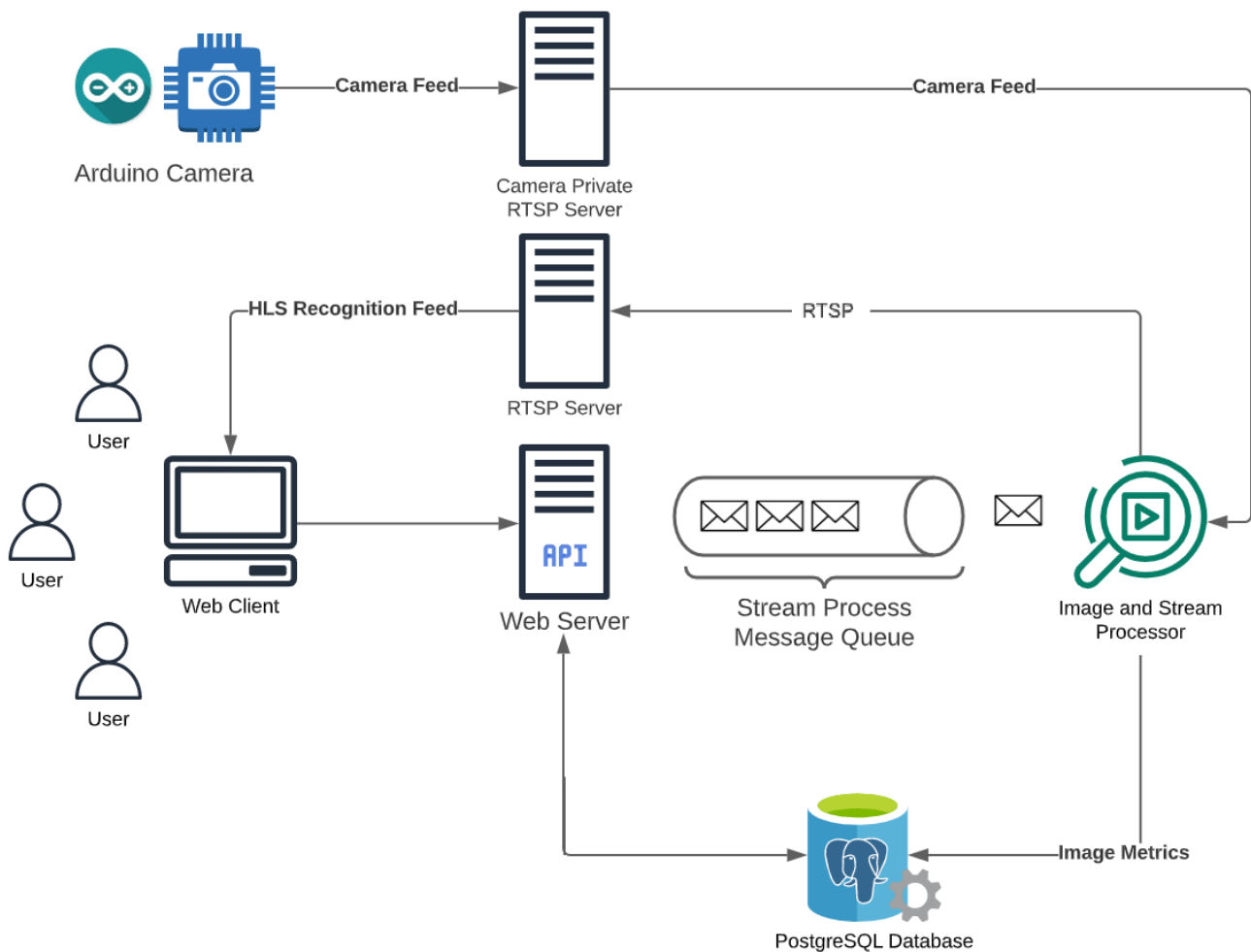


Figure 1: System architecture

Figure 2 illustrates the project schedule.



Figure 2: Gantt chart

References

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