



**BILKENT UNIVERSITY**

**CS491/492 - Logbook**

**Berkin Kağan Ateş**

**22102519**

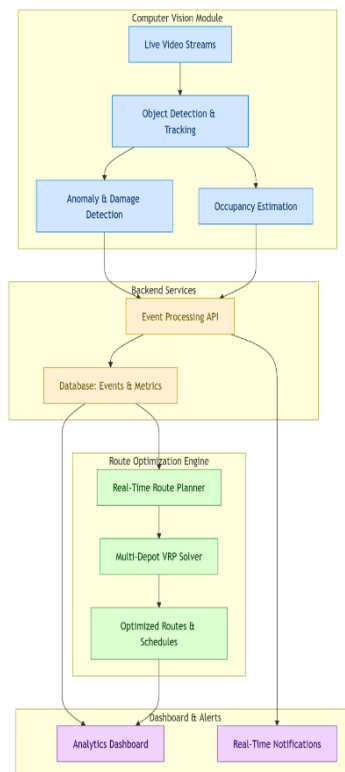
# Fall Semester - 2025

## August

This month, we identified our supervisor and the key elements of the project structure. I identified constraints in our general design and developed prospective approaches to address them. To gain initial insight, I spoke with some of my family members who work in the logistics industry to learn about common problems in warehouses. We had our first meeting with our supervisor.

## September

This month, I identified and addressed some gray areas in our project, including the warehouse workflow and route optimization. My friends and I determined some innovation experts to email. I sent our first diagram on the project to our supervisor, Doruk Öner. The diagram was as follows:

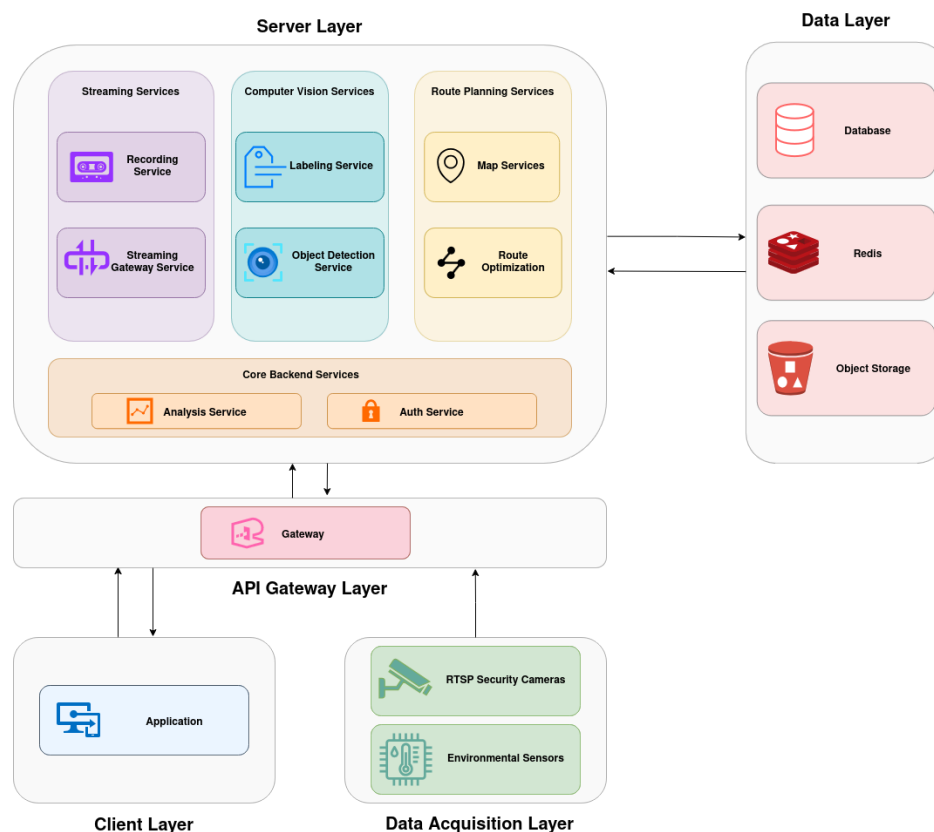


## October

This month was filled with numerous email flows. I emailed Ali C. Beğen to offer him the Innovation Expert position. Because he had a background in network communications, which is the backbone for our project for containing camera RTSP streams and sensors. Additionally, we applied to the AI mentorship program and were matched with Onur Bıçakçı. We conducted our first email to him that month. I ran my first experiments relaying an RTSP stream through an FFMPEG pipeline to a YOLO Docker image to measure the delay. I experienced approximately 1 second of delay with a camera on my subnet.

## November

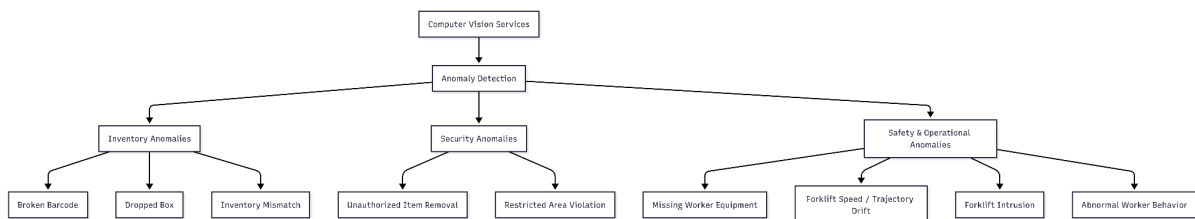
This month was full of meetings. We met with Onur Bıçakçı, who provided valuable insights into the barcode idea, helping us determine our B and C plans for the extreme cases. According to his valuable suggestions, we developed our high-level architecture:



According to our high-level design, I started implementing the microservices structure. It was not a further implementation, but I decided on the project folder structure and DevOps pipelines. I then began coding the frontend to refine use cases and scenarios.

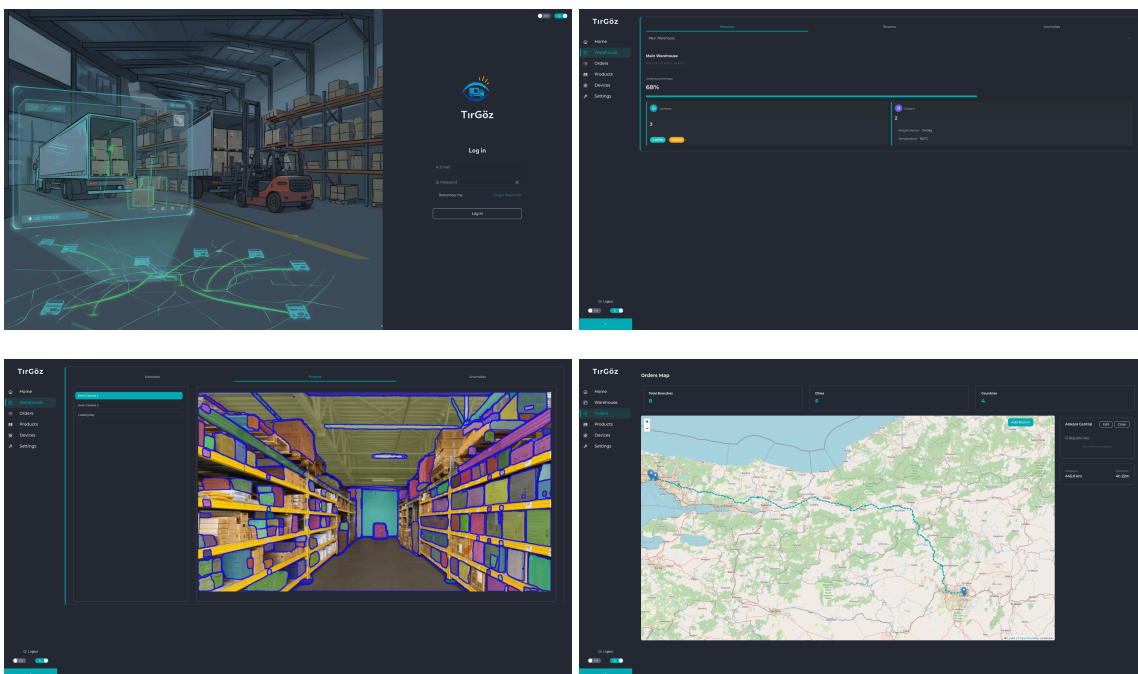
# December

This month, we determined our main use cases and work packages. We highlighted some risks in our computer vision model. There might be a dataset issue, so we addressed our concerns to Onur Bıçakçı, who advised us to consult with Ergin Selim Gönen, who runs a synthetic data company in Canada. As a result of our meeting, we decided to keep the synthetic data produced by maze-creating algorithms and Blender as a backup plan. Therefore, I edited the DevOps pipeline and the microservice architecture. I separated the anomaly detection concept in the project into three:



I introduced the specialized barcode problem that we can use as a backup plan to increase the robustness of the computer vision module.

Another area where I made significant progress was frontend development. I have nearly completed the frontend backbone and am preparing for the backend module and other microservices. Here are some screenshots from the backbone of the frontend design:



# Spring Semester - 2026

January - Winter Break

February

Our models struggled to achieve reliable object detection performance in real warehouse conditions, including occlusion, varying lighting, overlapping cargo, and limited camera angles. To improve the system's accuracy and consistency, we decided to integrate ArUco barcodes into the process. By placing ArUco markers on cargo and loading units, the system can more reliably detect, identify, and monitor items throughout loading sessions, enabling more stable tracking and validation during warehouse operations.

