ROBOVOYAGER

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Introduction

RoboVoyager is a robotics project aimed at enabling remote control, viewing capabilities and vision for a robot via a website interface. The project focuses on developing a user-friendly interface and implementing functional features for effective robot operations while ensuring the establishment of a low-latency, reliable connectivity. Additionally, **RoboVoyager** incorporates AI for object detection & segmentation tasks and integrates the chosen AI model.

Feature Detailes

6 main features of the RoboVoyager Website are listed as:

Controls: Virtual joystick using NippleJS.

Video Streaming: Using openCV and Rosbridge.

Sensor Monitoring: Data extracted from Jetson's components and Arduino module.

Data Collection: Captured from Zed 2 camera, Lidar, and GPS.

Object Detection : Using a finetuned YOLOv8 model .

Segmentation: FCN model provided in PyTorch.

Figure 1 : Real Mobile Robot used in the project

Methodology

RoboVoyager project a package-based approach was used which consists of 3 main components: **frontend** (website in Sveltekit), **middleware** (Rosbridge for websocket connection), and **backend** (ROS for controls and AI models).

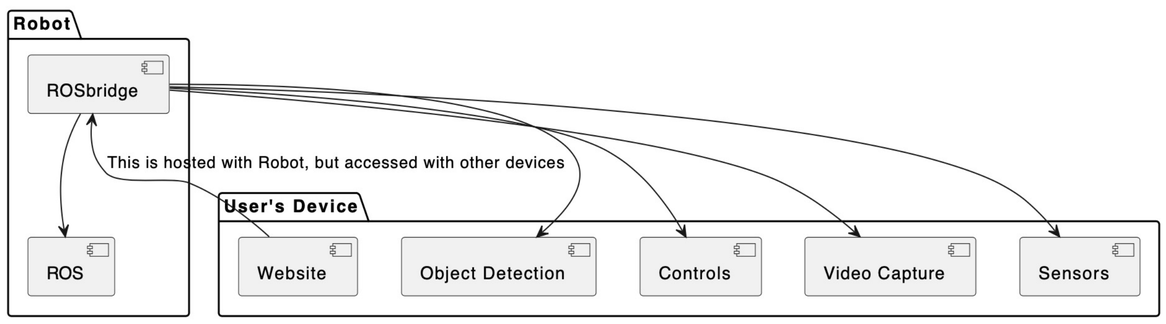

Figure 2 : An overall description of the Project structure

AI features :

YOLOv8 model is utilized for **real-time object detection** and Fully Convolutional Network (FCN) model which is available in pytorch is used for **semantic segmentation.** By processing images from the Zed 2 camera, the model identifies and classifies objects, enhancing the robot's ability to understand its surroundings and providing help for robot to navigate in the environment.

QR Code For the RoboVoyager Github Page

QR Code For the RoboVoyager Website

User Interface

Interface includes three primary pages as shown in the *Figure 3*.The Key features of the interface include a responsive design for compatibility with both phones and computers, a virtual joystick for robot control, real-time video streaming, and comprehensive sensor data monitoring.**The SvelteKit framework** was chosen for its component-based architecture, page routing capabilities, and ease of use.

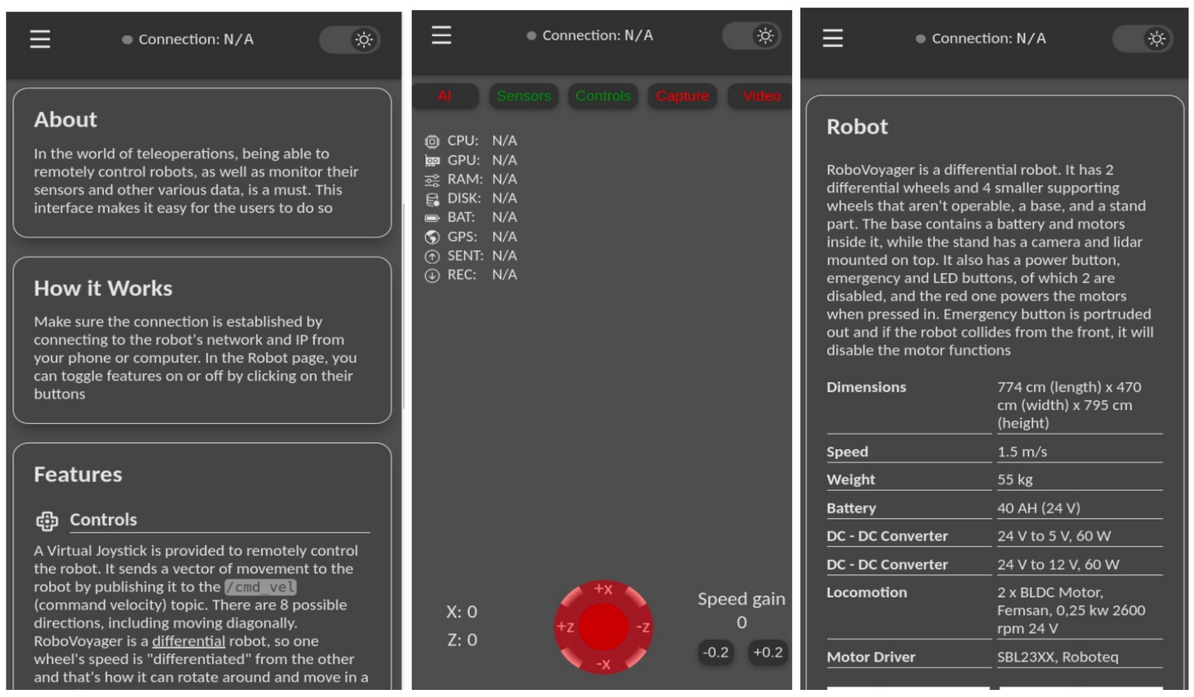

Figure 3 *: Home, Robot and Specification pages of the Website*

Results and Discussion

RoboVoyager offers a cross-platform , easy to use interface for remote robot operations, serving as a reference for future teleoperations projects. Main results of the project includes:

- effective robot movement within a 30m range outdoors and 15-20m indoors.
- Smooth video streaming on a localhost -reduced performance with multiple users due to TCP and Rosbridge limitations-.

Moving forward, enhancements such as internet connectivity for global access, more advanced AI features, and system upgrades (e.g., migrating to ROS 2 and implementing webRTC) could improve the Project's capabilities .

References

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❑ Quigley, Morgan & Conley, Ken & Gerkey, Brian & Faust, Josh & Foote, Tully & Leibs, Jeremy & Wheeler, Rob & Ng, Andrew. (2009). ROS: an open-source Robot Operating System. ICRA Workshop on Open Source Software. 3.

Acknowledgements

This project was completed within the context of BBM479/480 Design Project Course as a Graduation Project at Hacettepe University, Faculty of Engineering, Department of Computer Engineering.

We thank our superviser Asst.Prof. Özgür Erkent for his invaluable contributions to our project.