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GESTURE BOT

Practical utilization of gesture recognition in motion-controlled robotics

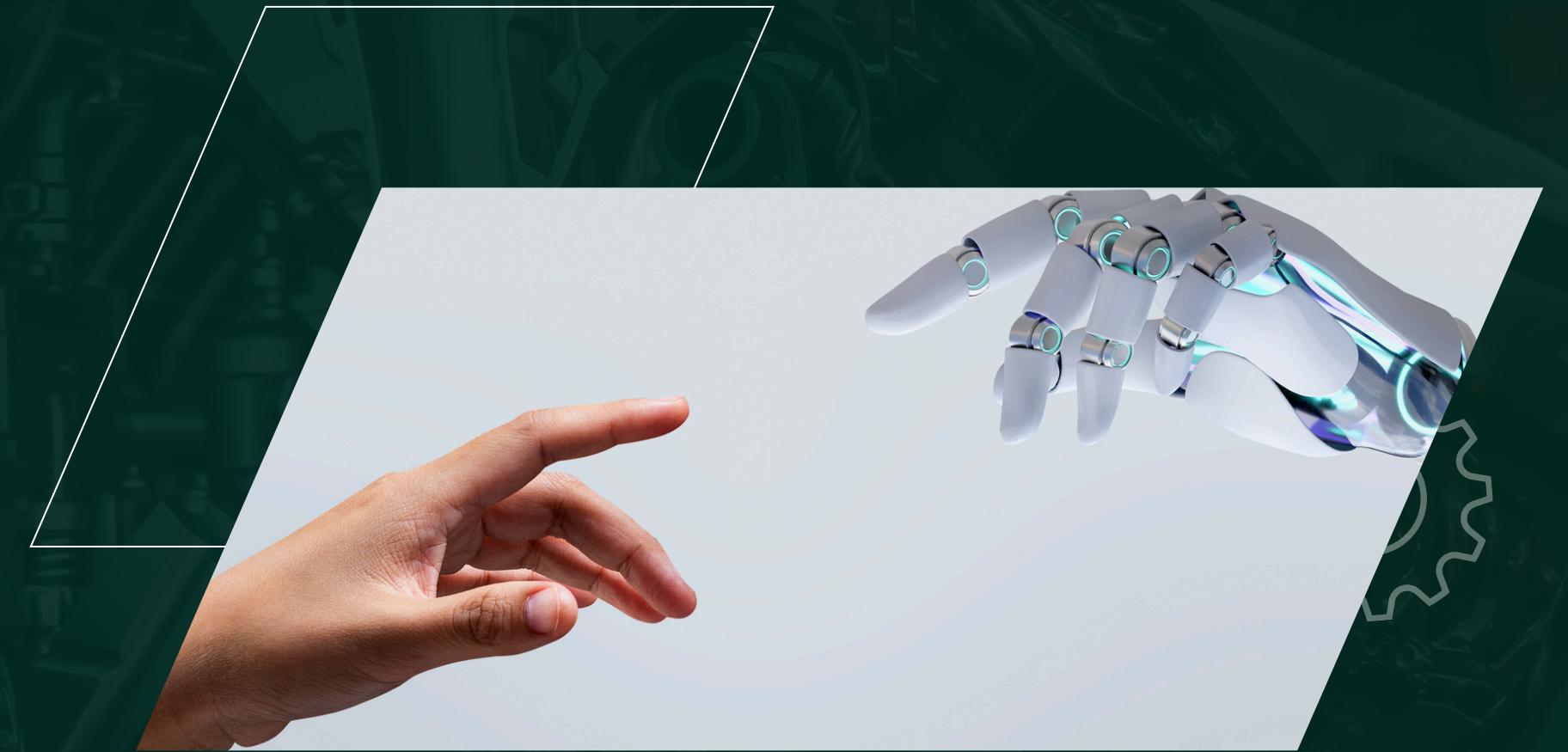
Group 3:

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PROJECT IDEA

- Gesture-controlled mobile robot
- Enables more intuitive human–robot interaction
- Uses two-hand control: one for navigation, one for arm movement
- Provides live camera feedback for the operator





CHALLENGES



Gesture recognition accuracy

Reliable gesture recognition under varying lighting conditions and hand orientations



3D positions

3D hand tracking without depth sensors



System Integration

Seamless communication between PC and robot (e.g. signal transmission problems)



Complicated Setup

Complex setup and compatibility issues across multiple PCs



SOLUTIONS



MediaPipe

- 21 hand landmarks detected via MediaPipe
- Fast and accurate real-time recognition pipeline
- Hand-Landmark-Pipeline with pretrained model



MediaPipe 3D mapping

- MediaPipe provides simple 3D detection
- Estimating missing position data using 3D landmark projection (approximation, not full depth)
- **Different approaches for arm movement (e.g. LiDAR-based or visual estimation) are currently being evaluated**

ROS 2 Humble

- controlling robot velocities
- manages communication between RaspberryPi and PC

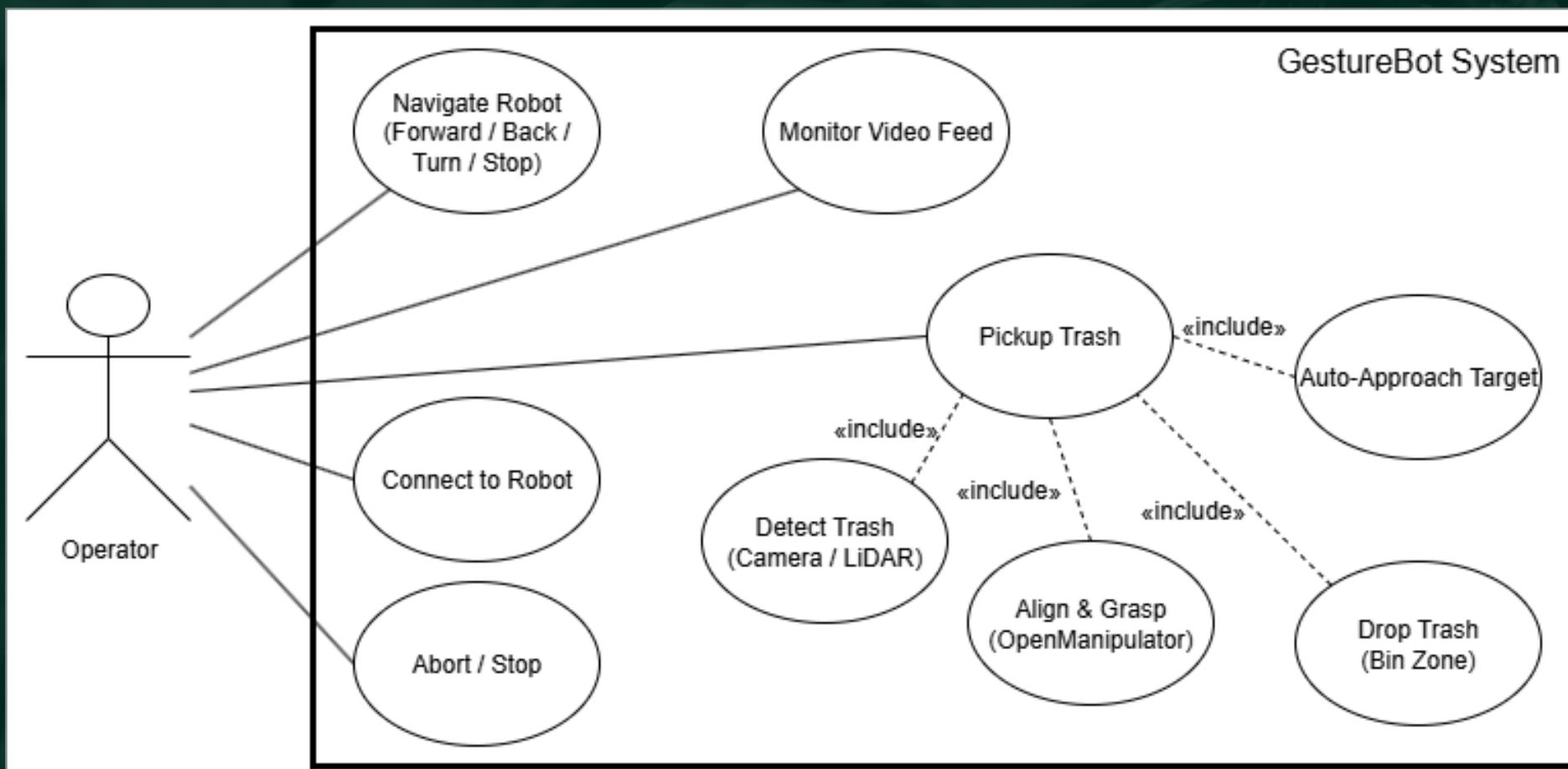
Docker

- Docker container for consistent, plug-and-play system setup



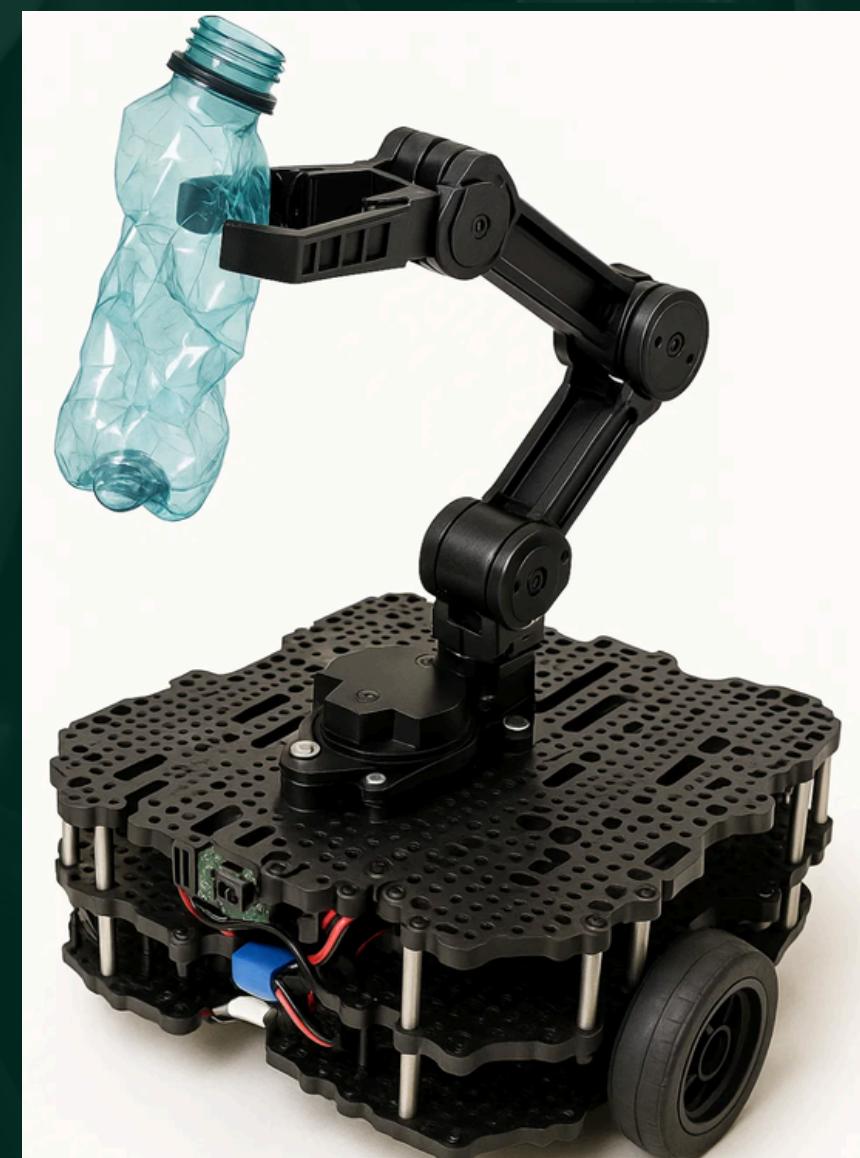
FUNCTIONAL REQUIREMENTS

- Gesture-based movement control
- Gesture-based arm activation and positioning
- Real-time video feedback



USE-CASE SCENARIO

“Trash Pickup” – robot identifies and picks up a nearby object





DATASET & SYSTEM HARDWARE SETUP

DATASET

- Based on a non-public MediaPipe dataset (Google)
- Pretrained neural network model for hand landmark detection

SYSTEM

- TurtleBot3 Waffle Pi with Raspberry Pi 4
- ROS 2 Humble running on both PC and Pi (via Docker)
- Wi-Fi connection between PC and robot
- All computation handled on PC; Pi receives movement commands
- ROS Publisher–Subscriber architecture for modular design





NEXT STEPS

PLANNING

No major changes in project timeline

- Integrate and test robotic arm control functionality
- Continue testing and troubleshooting of the ROS setup
- Finalize Docker container for easy deployment
- project report and preparing demonstration

OBSTACLES

- Occasional communication issues in university network
- Video output stability issues
- Outdated camera package dependencies







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THANK YOU

Questions & feedback are welcome!