REMEDY

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Background

The US Navy spends billions of dollars annually to maintain their ships, and such maintenance can place sailors in dangerous environments. To reduce the cost and keep sailors safe, the Navy needs a solution that can do various tasks, is easily replaceable, and requires little supervision. The most promising solution to these issues is in the form of GNAR, a mobile robot robustly designed with caterpillar treads and a multi-link arm.
To make this robot even more viable as a solution, we are making it autonomous.

Challenge Course Overview

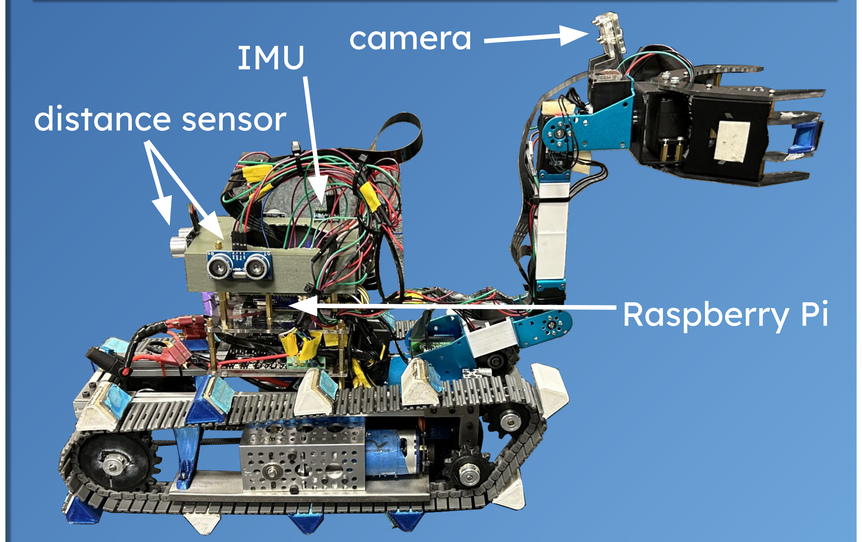
- Door latches
- 60° stairs
- Walled platform
- Light switch
- Simulation of a rocking ship

To test out its real-world capabilities, GNAR will go through an obstacle-course challenge with a ship-like environment.

Solution Overview

Challenges	Solutions
Navigation	Distance sensors help determine the robot's location on the course.
Traversal	IMU reads orientation in 3D space. Arm helps maintain balance on the stairs.
Object Detection	Camera and distance sensors identify an object's location through a detection algorithm.

Final Design

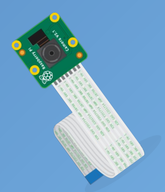


Gaucho Navy Auto Robot (GNAR)

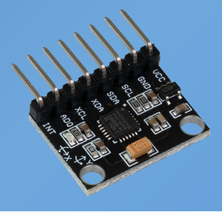
Key Components

Raspberry Pi 4 Model B
The computer of the robot using Ubuntu Linux

HC-SR04 - Ultrasonic Sensors
Measures distance away from vertical objects in the range of 2 ~ 400 cm, used to wall avoidance.

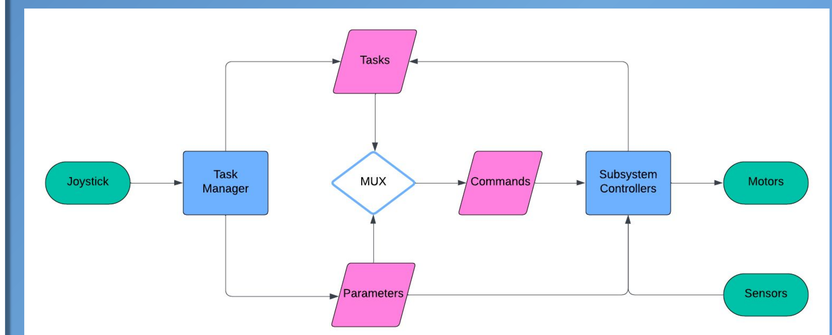


Raspberry Pi Camera V2
Capture 8MP still images and use AI YOLO algorithm to detect objects such as latches and buttons.

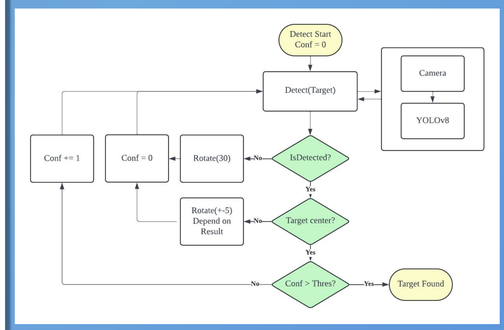


MPU6050 IMU
Inertial Measurement Unit that can measure pitch, yaw, roll, and acceleration to control the robot and situational awareness.

Software Block Diagram



Artificial Intelligence



The YOLOv8 trained model is applied to distinguish complex environments, ensuring high recognition accuracy.

Key Results

Task	Completion Rate(%)	Avg Completion Time(s)
Latch And Door	40	120
Climb Stairs	10	150
Wall Avoidance	80	35
Down Stairs	50	15

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