AI-Enhanced Maritime Management: Integrating Lidar, Yolo and OCR for boat Surveillance

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Abstract: The rapid advancement of an autonomous surveillance boat designed to enhance port security and management through artificial intelligence vessel monitoring. The project presents a cost-effective solution for maritime vessel tracking and reporting by introducing an autonomous boat equipped boat equipped with Lidar/Ultrasonic Sensor for obstacle detection. The boat efficiently classifies diverse vessels within the port. Complementing this, an Optical Character Recognition (OCR) system identifies hull numbers, cross verifying their presence in the port, and consolidates all patient data on a web server. This holistic approach addresses the challenges of monitoring vessel activities, detecting encroachments, and managing information pertaining to violators within port limits, offering a streamlined and technologically.

Keywords: Lidar / Ultrasonic Sensor, ESP3266, Relay sensor, DHT11 sensor.

I. INTRODUCTION

In the ever-evolving realm of maritime operations, the need for cost-effective and technologically advanced solutions for tracking and reporting vessels within port limits is critical. This abstract proposes an innovative approach centred around on autonomous boat equipped with Lidar technology, designed to navigate port waters and efficiently detect obstacles. Complementing its capabilities, the boat incorporates a YOLOv8-based artificial intelligence model, allowing for the accurate classification of diverse vessels with on the port area. This integration of cutting-edge technology not only enhances the precision of vessel tracking but also lays the foundation for a comprehensive maritime monitoring system. Furthermore, to bolster the solution's capabilities in managing maritime activities, an Optical Character Recognition (OCR) system has been implemented. This system is adept at identifying and capturing hull numbers on observed vessels, cross-referencing this data with the port's database. The consolidation of this information on a centralized web server ensures real-time monitoring and reporting activities within the port.

II. METHODOLOGY

Boat/Object Detection: A camera installed on the surveillance platform continuously observes the port boundary. The video stream is processed using the YOLO algorithm implemented with OpenCV to detect and locate boats by drawing bounding boxes around them. Simultaneously, an ultrasonic sensor linked to the ESP32 controller measures the proximity of approaching objects, providing accurate distance information. The combination of visual and distance data ensures reliable detection and tracking of nearby vessels.
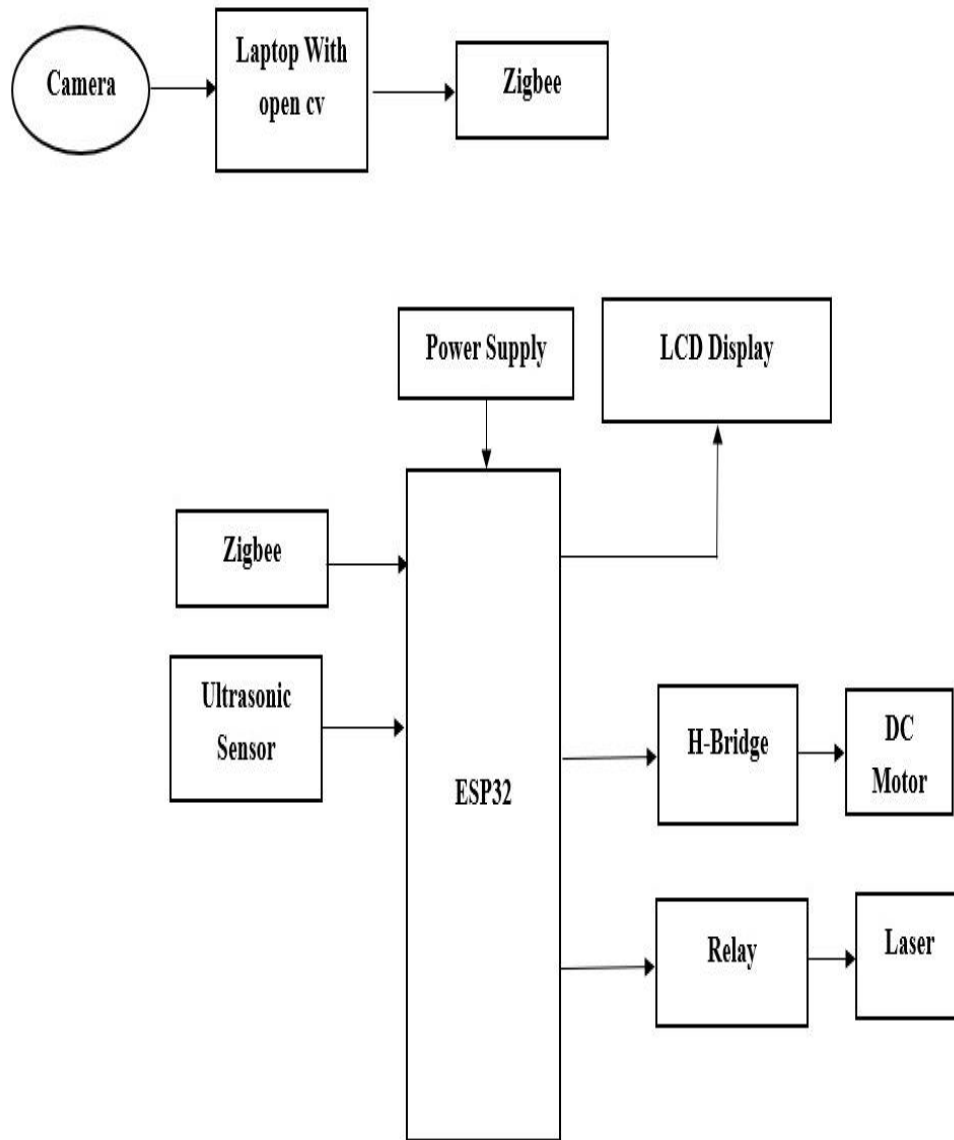
Figure 1: Block Diagram of AI-Enhanced Maritime Management: Integrating Lidar, Yolo and OCR
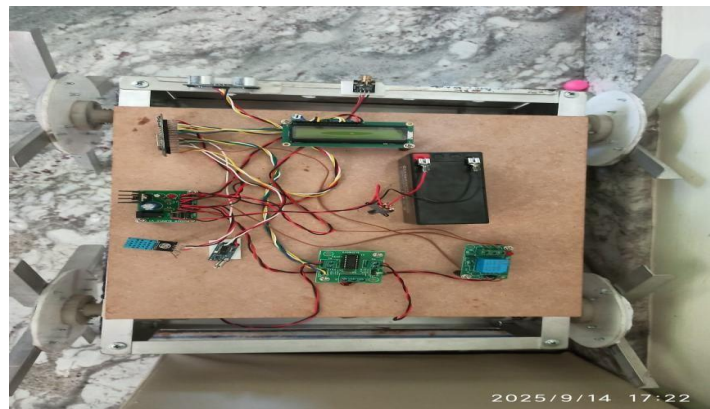
III. RESULT

Figure 2: Working Model

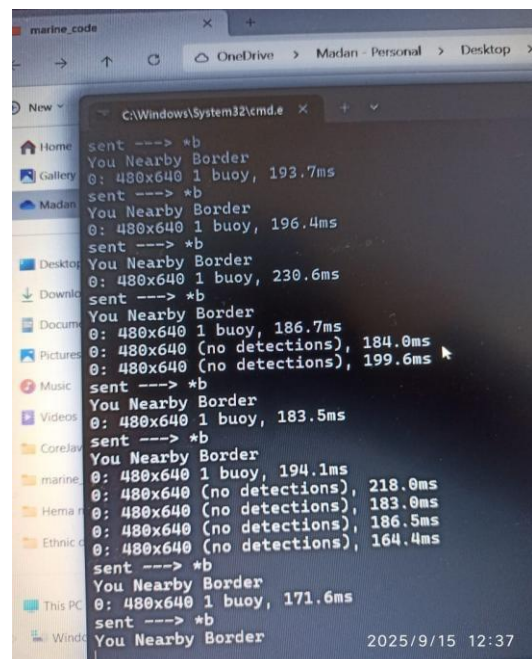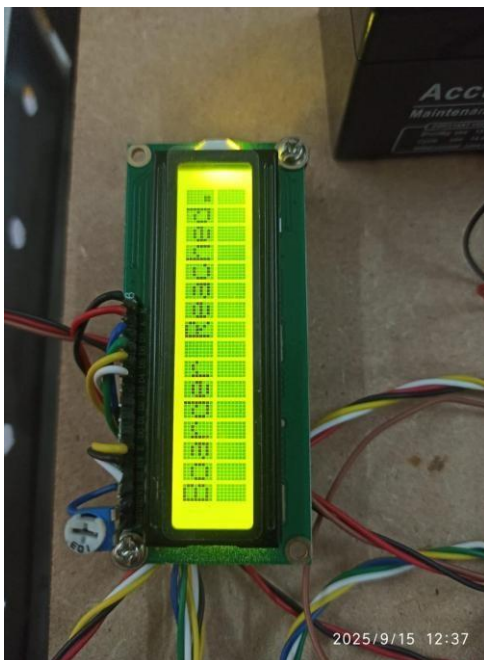Figure 3: Message Received in Telegram

Figure 4: A Border

Figure 5: Sending message as *b for border reached and nearby border
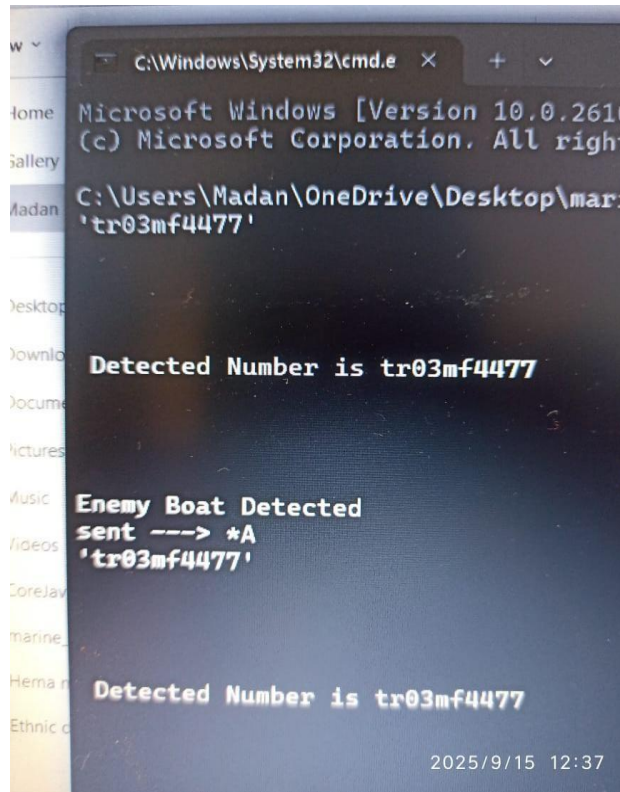
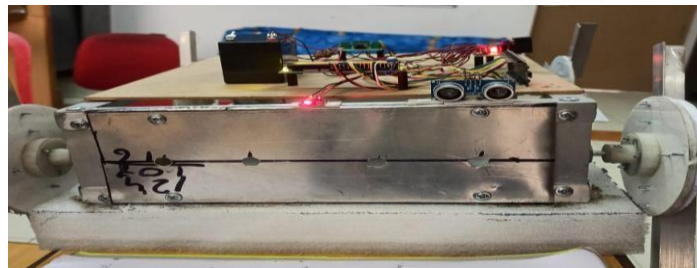Figure 6: Sending message as *A for Enemy Boat detection

Figure 7: Targeting and Shooting for Enemy boat

IV. CONCLUSION

The proposed system integrates AI, IoT, and robotics for maritime surveillance. By combining ultrasonic detection, YOLO+OCR recognition, and real-time alerts, the system ensures enhanced security at ports and maritime borders. AI enhanced maritime management that integrates Lidar, YOLO, and OCR offers a powerful and intelligent approach to boat surveillance. By combining precise 3D mapping, real-time object detection, and automated text recognition, this system greatly improves maritime safety, security, and monitoring efficiency.

FUTURE SCOPE

It can be deployed in ports & coastal regions. As sensor and computing technologies continue to advance, Lidar can provide even more precise 3D mapping and object detection in challenging maritime environments such as fog, darkness, or rough seas. YOLO, with ongoing improvements in real-time image recognition, will enable faster and more accurate identification of vessels, obstacles, and human activities. OCR will further enhance monitoring by automatically reading ship names, registration numbers, and warning signs from video feeds, improving vessel tracking and regulatory enforcement.

ACKNOWLEDGMENT

REFERENCES

[1]. Bakker K., "Water Security: Research Challenges and Opportunities," Science, 2021.
[2]. Jin D-L., Liu Y-W., "An Overview of the Water Environment," Water Resources, 2020.
[3]. J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., Clarendon Press, Oxford, 1892.
[4]. Perez C.A. et al., "A System for Monitoring Marine Environments Based on Wireless Sensor Networks," IEEE OCEANS Conference, Santander, 2022.