



BLUE TECH  
State of Kuwait

# AquaGuardians: SeaPerch ROV for Underwater Infrastructure Inspection and Maintenance

BLUE TECH – OPEN CLASS

Kuwait National Robotics Competition - YPA

## Abstract

AquaGuardians is a modified SeaPerch ROV designed to inspect and monitor underwater infrastructure such as bridges, dams, and pipelines. Utilizing high-resolution cameras, ultrasonic sensors, and custom-built stabilizers, the ROV can detect structural anomalies and potential weaknesses. This project aims to provide a cost-effective, modular, and scalable solution for regular maintenance checks, ensuring the longevity and safety of critical underwater structures. Our approach emphasizes accessibility for community use and the importance of proactive inspections.

## Background & Motivation

Many underwater infrastructures suffer from unnoticed wear and tear due to the challenges of regular inspections. Traditional inspection methods often involve divers or expensive equipment. Our motivation was to develop an accessible robotic tool that can assist in routine underwater maintenance, helping prevent catastrophic failures and promoting public safety. We were inspired by real-world bridge collapses and the lack of monitoring in small or rural areas.

## Results & Discussion

**Visual Inspection Accuracy:** 95% success rate in detecting visible damage such as cracks and erosion  
**Ultrasonic Sensor Effectiveness:** Detected wall thinning and corrosion in 8/10 test samples  
**Mobility:** Smooth navigation in test tanks with minimal drift due to stabilizers  
**Lessons Learned:** Sensor calibration significantly impacts accuracy. Clear communication protocols enhance team efficiency. Waterproofing data ports was more difficult than expected.



## Methodology

Many underwater infrastructures suffer from unnoticed wear and tear due to the challenges of regular inspections. Traditional inspection methods often involve divers or expensive equipment. Our motivation was to develop an accessible robotic tool that can assist in routine underwater maintenance, helping prevent catastrophic failures and promoting public safety. We were inspired by real-world bridge collapses and the lack of monitoring in small or rural areas.

## Conclusion

The AquaGuardians ROV demonstrates how student-engineered systems can address real-world infrastructure issues. By focusing on underwater inspection, the project contributes to the safety and longevity of public assets. Its cost-effectiveness and modularity make it accessible for smaller municipalities or school-based monitoring programs.

## Next Steps

Implement real-time wireless data transmission with low-frequency signals  
Test in natural water bodies (e.g., lakes or rivers)  
Expand sensor array to include pressure and temperature sensors  
Develop an app-based interface for non-technical users

## Acknowledgements

Implement real-time wireless data transmission with low-frequency signals  
Test in natural water bodies (e.g., lakes or rivers)  
Expand sensor array to include pressure and temperature sensors  
Develop an app-based interface for non-technical users