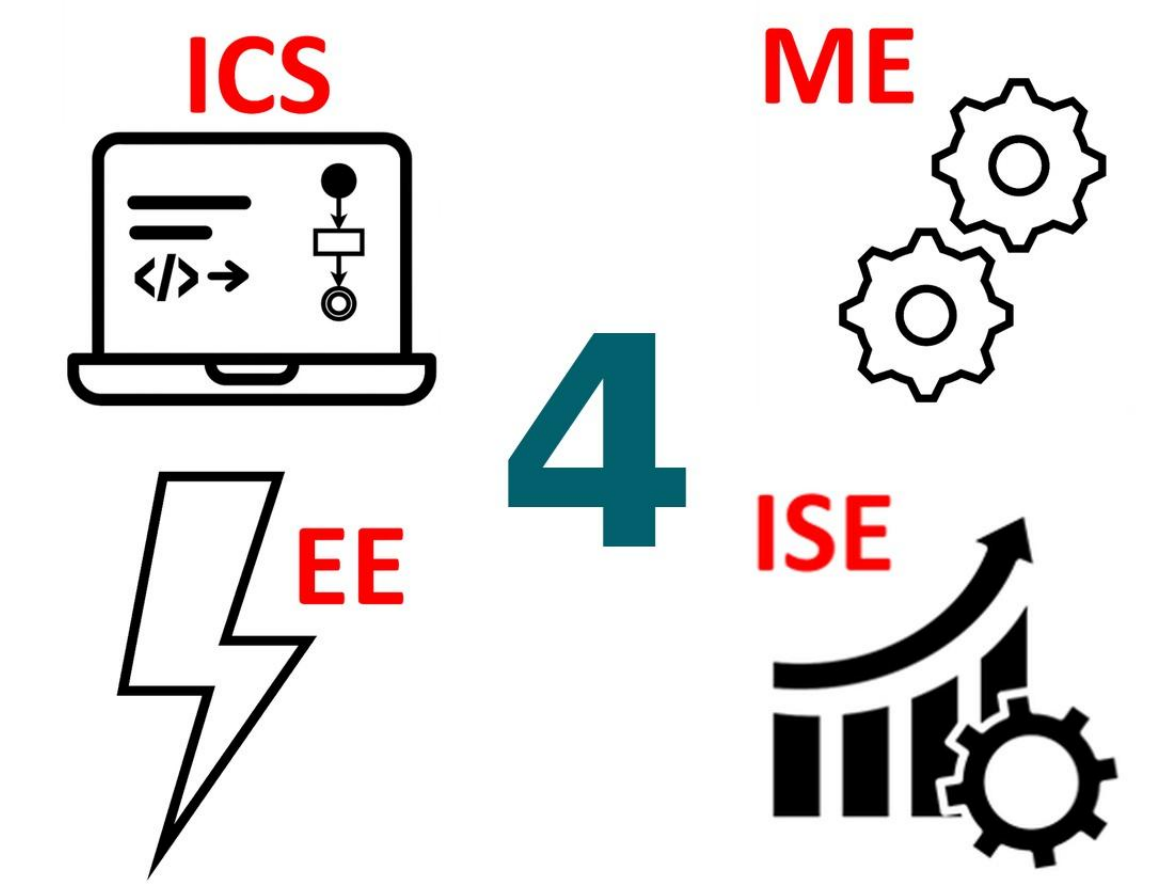


Aqua Guardian AI: Intelligent Drowning Detection and Autonomous Rescue System

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Introduction

Drowning is a critical global safety issue, causing over 236,000 deaths annually, with children among the most affected. Despite its severity, many of these incidents are preventable with faster detection and response.

Problem Statement

Drowning occurs silently and within seconds, while current safety measures rely on delayed human observation. This creates a critical gap where immediate action is often missed. There is a strong need for an intelligent solution that can detect drowning in real time, trigger instant alerts, and enable rapid rescue.

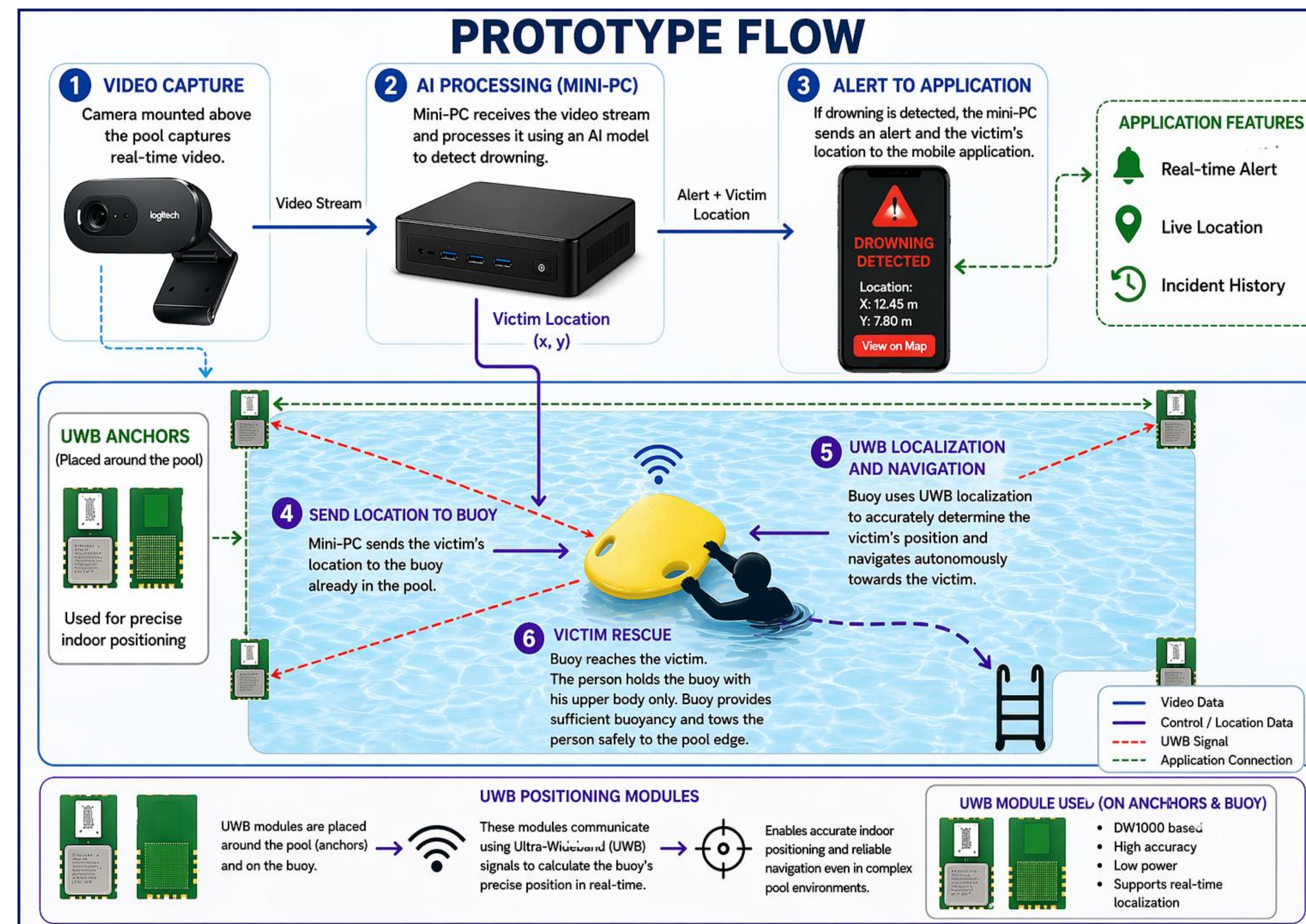
Specifications

| | |
|--------------------------------|---------------------------|
| Drowning detection ≤ 15 s | Localization ≤ 0.5 m |
| Rescue initiated ≤ 30 s | Alert Delay ≤ 2 s |
| Full Rescue ≤ 60 s | Buoyancy ≥ 90 kg |
| Edge Radius ≥ 0.005 m | |

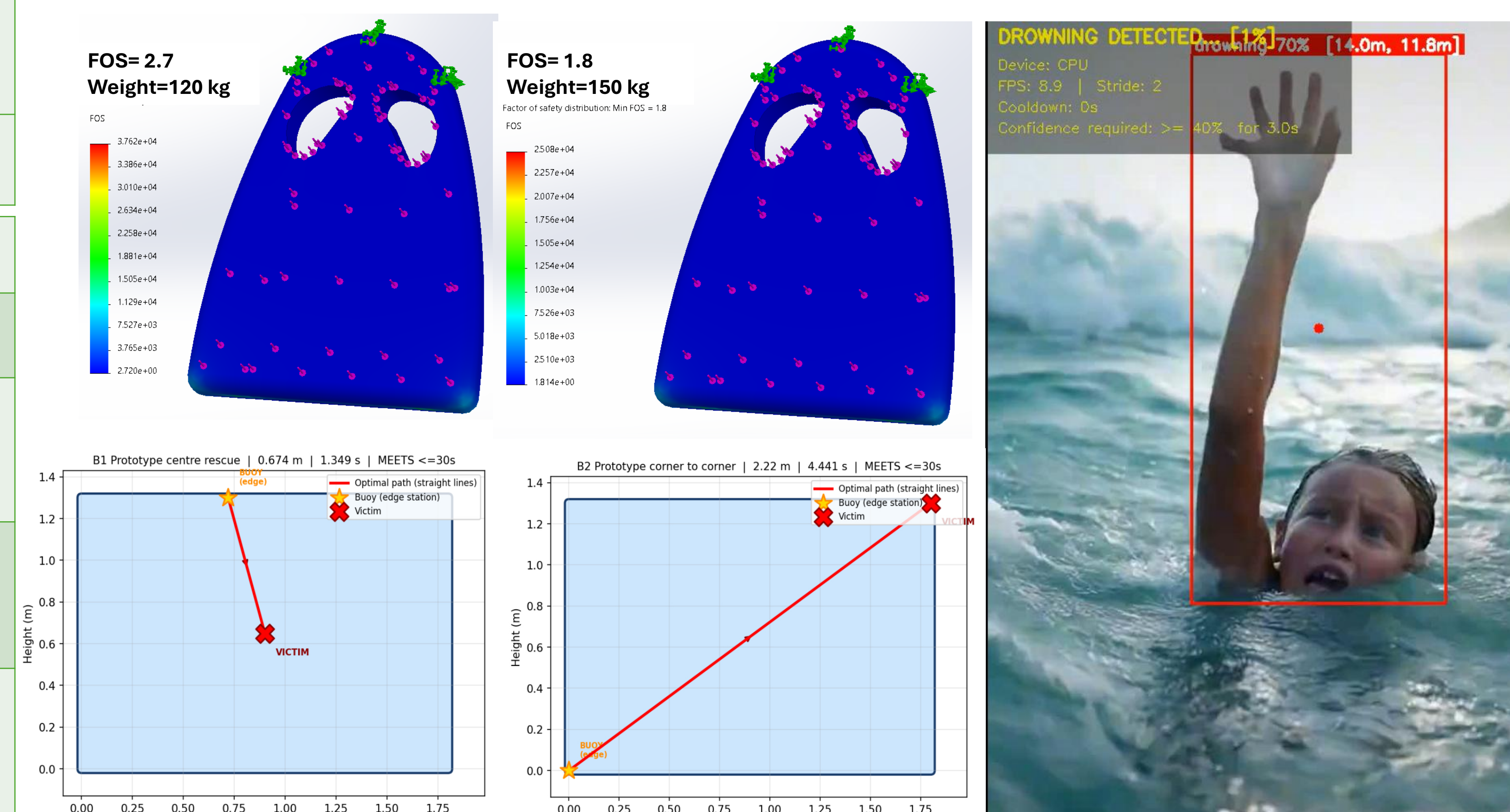
Constraints

| | |
|------------------------------|----------------------------------|
| Cost Limit $\leq 12,000$ SAR | Freeboard ≥ 0.01 m |
| Safety Factor ≥ 2.5 | Operating voltage ≤ 40 V DC |
| Edge Radius ≥ 0.005 m | Buoyancy ≥ 90 kg |
| 30% packet loss tolerance | Waterproof (IP44) |

Prototype



Test & Validation



Achievements

- ≤ 15 s drowning detection achieved
- ≤ 30 s autonomous rescue response
- ≤ 0.5 m localization accuracy
- $\geq 90\%$ system reliability validated = 99.3%
- Structural capacity up to 120 kg
- Safe edge design with radius ≥ 0.005 m

TARGET USERS

- POOL OPERATORS**: Ensure comprehensive facility safety compliance and oversight.
- LIFEGUARDS**: Augment human vigilance and enable rapid, guided response.
- PARENTS**: Achieve peace of mind with real-time remote monitoring and alerts.
- SPORT CLUBS & SCHOOLS**: Optimize safety during structured swim training and classes.

SCAN ME

Conclusion

By providing rapid detection, immediate alerts, and autonomous rescue support, this project increases emergency response efficiency and improves swimmer safety. It shows the value of AI-based systems in creating smarter and safer aquatic environments.