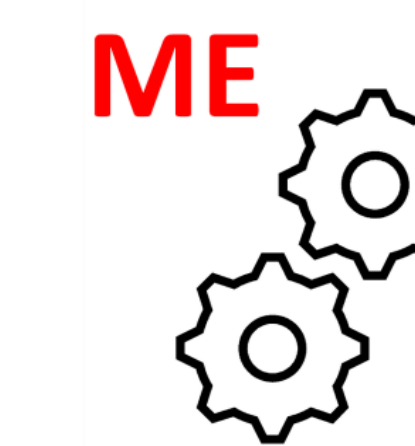


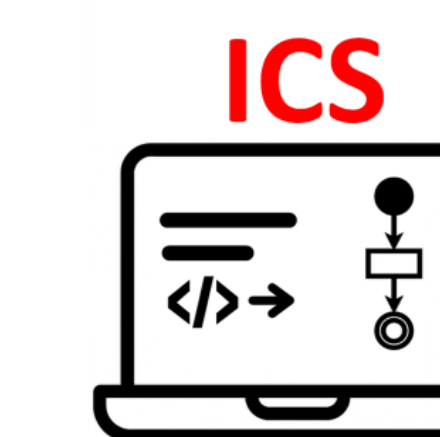
# AI-Assisted Optimization of Rotary Steerable System (RSS) to Enhance Drilling Efficiency

TEAM  
M099

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## Background

Global energy demand requires more efficient hydrocarbon extraction methods. Directional drilling using Rotary Steerable Systems (RSS) enables precise wellbore placement to maximize reservoir contact. This project develops an AI-assisted optimization system for RSS, enabling autonomous, real-time downhole steering beyond traditional surface control. The goal is to improve drilling efficiency, reduce non-productive time (NPT), and enhance wellbore quality, addressing limitations in current practices.

## Problem Statement

current RSS drilling process is inefficient due to reliance on delayed surface-based decision-making and human interpretation, resulting in high non-productive time, poor responsiveness to downhole conditions, and reduced drilling accuracy.

## Constraints

The system shall support real-time steering decisions by limiting downhole inference and command generation to the specified latency target

Dogleg severity must remain :  
DLS < 8/ 100 ft

Project Cost ≤ 10,000 SAR

## Specifications

Dashboard response time ≤ 1 second

Reduction in RSS-related NPT ≥ 20%

Targeted Tool Weight < 20KG

Maximum operating temperature: 150 °C  
under downhole drilling conditions.

## Integrated Specifications

System availability ≥ 95%

Overall efficiency improvement ≥ 10%

Integrated system accuracy ≥ 85%

## Testing Summary

The prototype was validated through discipline-based tests to ensure it meets all requirements:

- PETE (Drilling Performance):

DLS reduction: 46% (≥ 25%)

ROP improvement: 19% (≥ 10%)

- ME (Mechanical Integrity):

Safe design: FoS > 1.5

Stress below yield Weight: 5.6 kg (< 20 kg)

- CS (System Performance):

Accuracy: 87.9% (≥ 85%)

Latency: ~55 ms (≤ 100 ms)

Dashboard: ~337 ms (≤ 1 s)

Availability: 100% (≥ 95%)

## Conclusion

The project successfully developed an AI-assisted RSS system that enables real-time, autonomous downhole steering, addressing the limitations of traditional surface-based control. The integrated design met all key requirements, showing improvements in drilling performance through reduced DLS, increased ROP, and reliable low-latency AI decisions. The system demonstrates a feasible, safe, and efficient solution for enhancing drilling operations and provides a solid foundation for future development.

## Prototype

