TEAM M025

Design and Validation of an Integral Sleeve System for Pipeline Integrity Repair

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Background

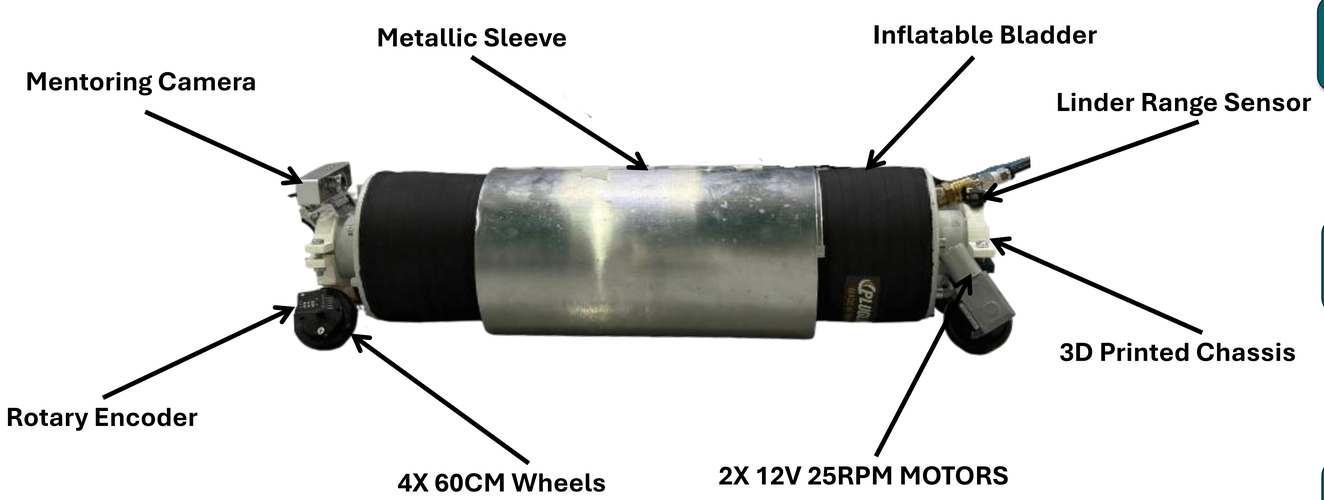
Problem:

- Pipeline maintenance teams require a safe and cost-effective method to restore sealing and structural support in internally damaged pipeline sections without excavation or welding

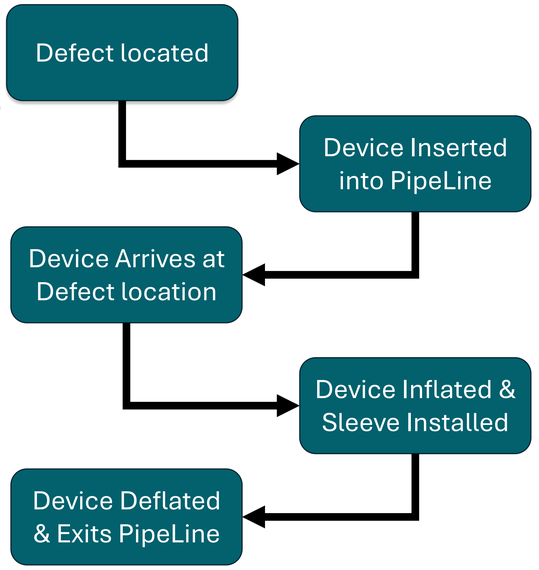
Solution:

- A wheel-based chassis containing an inflatable bladder will access the pipeline internally and install the metallic sleeve on the location of the defect, restoring structural integrity.

Prototype Development



Operation



Constraints&Specifications

Constraints:

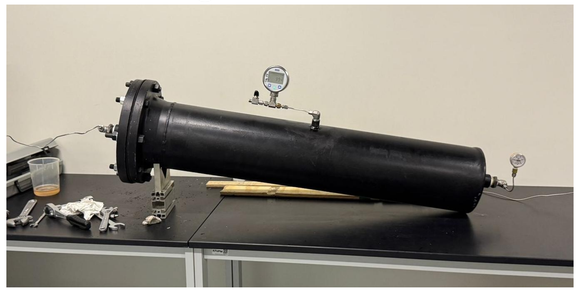
- Total cost under 10 000 SAR
- Travel speed: 0.05-0.20 m/s
- Internal Pressure: 6 Bar
- Operation costs under 2000 SAR

Specifications:

- Inflatable bladder produces 2.5 Bar
- Chassis supports 8” – 10” ID pipeline
- Leak free sealing for 60 minutes
- Material strength: 180MPa
- Precise stopping accuracy: ±5mm
- Pressure drop under 5%

Testing & Validation

Sleeve Testing at 6 Bar:



Operation Optimization:

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Improvements vs baseline:
  Cost improvement: 36.30%
  Time improvement: 76.51%
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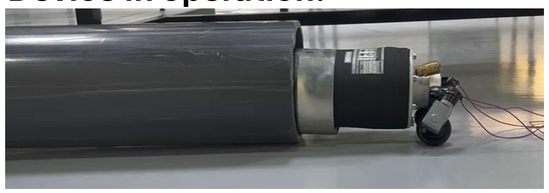
Inserted Sleeve:

Device in operation:



Conclusion

- An integral sleeve system was designed and assembled for pipeline integrity repair
- The system was tested, validated, and optimized to be ready for real-world applications.

Items	Cost
Inflatable Bladder	2000 SAR
Pneumatic System	485 SAR
Sensors	373 SAR
Other Costs	1,488 SAR
Total	4,346 SAR