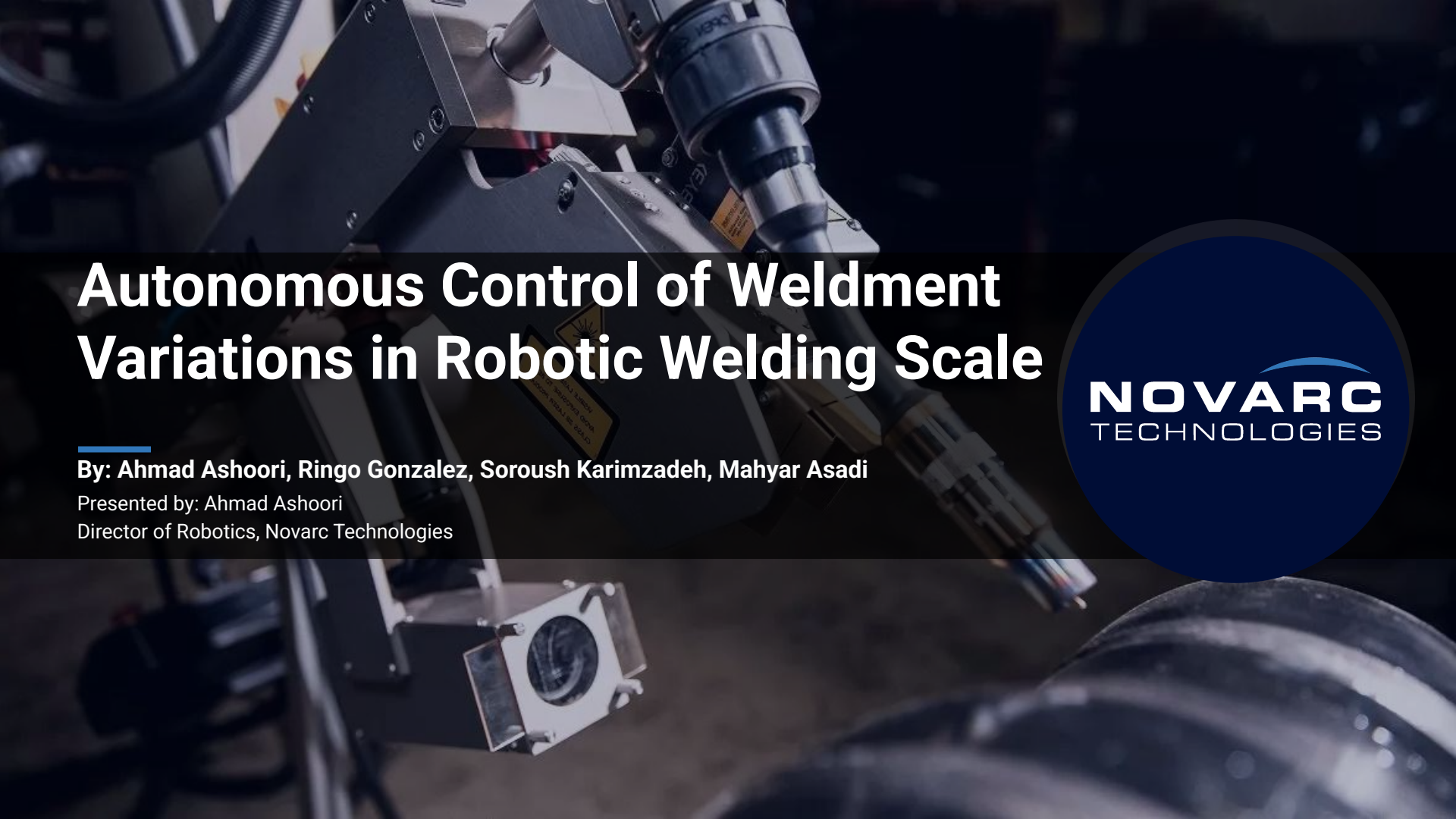

Autonomous Control of Weldment Variations in Robotic Welding Scale

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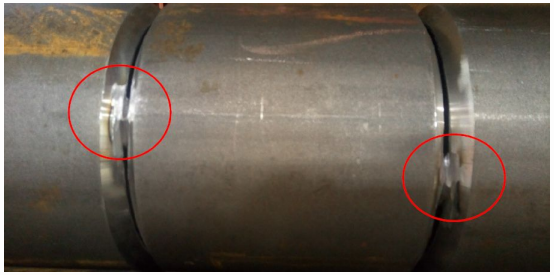
Introduction

- A huge need for pipe welding automation to address the welder shortage crisis
- The evolution of AI in pipe welding automation
- Laser sensors, vision systems, etc. to help automation

Novarc's Spool Welding Robot (SWR)

Problem Statement

- Challenges:
  - Recipe adjustments for gap width variance
    - Nonlinear pattern
    - Non-deterministic
  - Recipe adjustments for tacks
    - Non-deterministic
    - Variations in length and shape
- Blowthrough or lack of fusion if no adjustment is done



Tacks are shown in red circles.

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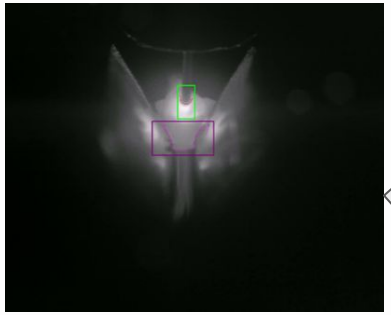
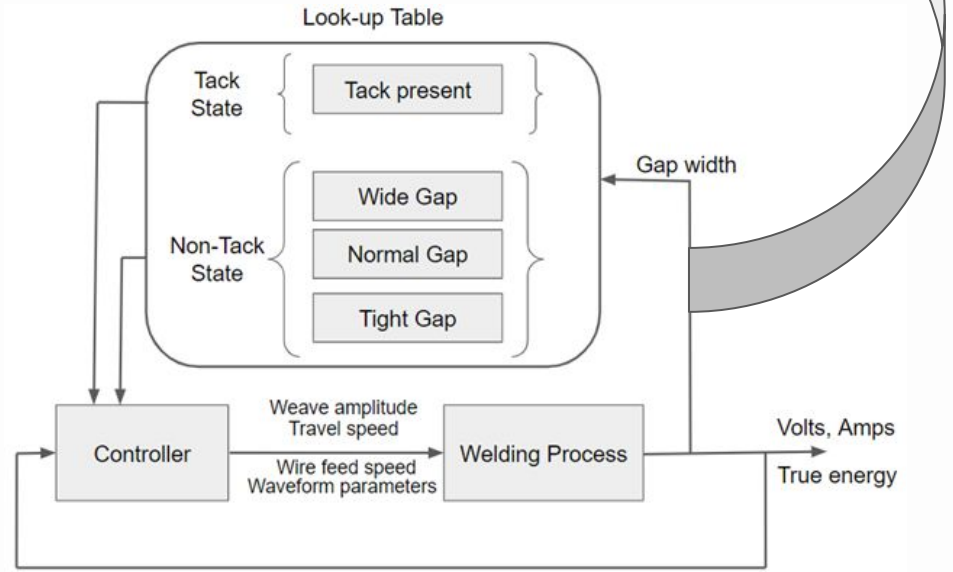
Controller Solution

- Real-time Adaptive control strategy
- Normal gap based on WPS
  - Wide gap is 30% bigger than normal
  - Tight gap is 30% smaller than normal
- Tack identification overrides all of the gap states



Novarc's Vision System



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Results

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Summary

- Our system addresses the problems in open-root welding; gap variations and tack detection
- This is being sold as a product. The sensitivity is 96.6% and the precision is 100%
- We are actively collecting more data from our customers to improve this system and also introduce its next generation

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