MICHIGAN STATE UNIVERSITY

Project Plan Presentation

Machine Performance Prediction

The Capstone Experience

Team AkzoNobel

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From Students…
…to Professionals

Project Sponsor Overview

- AkzoNobel is a global leader in the manufacturing of paints and industrial coatings
- Akzo acquired the Swedish company Nobel Industries and merged into Akzonobel in 1994
- We're working with their site in Warsaw, Indiana



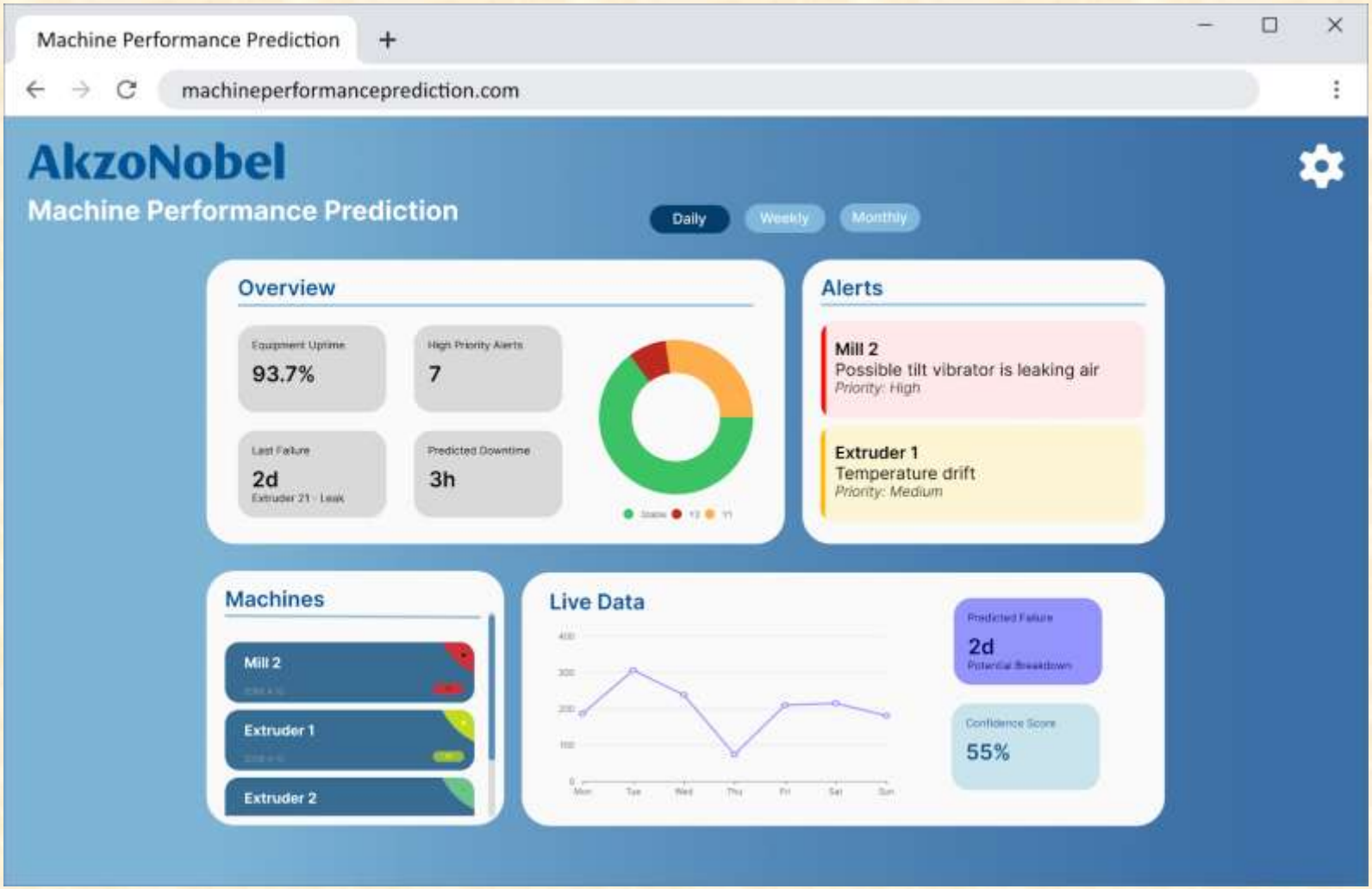
Project Functional Specifications

- AkzoNobel's Warsaw, Indiana site is the largest powder coatings manufacturing facility in North America
- Unplanned machine failure always leads to delays in delivery
- AkzoNobel wants is a way to predict and prepare for these catastrophic failures before they happen with desktop and mobile alerts

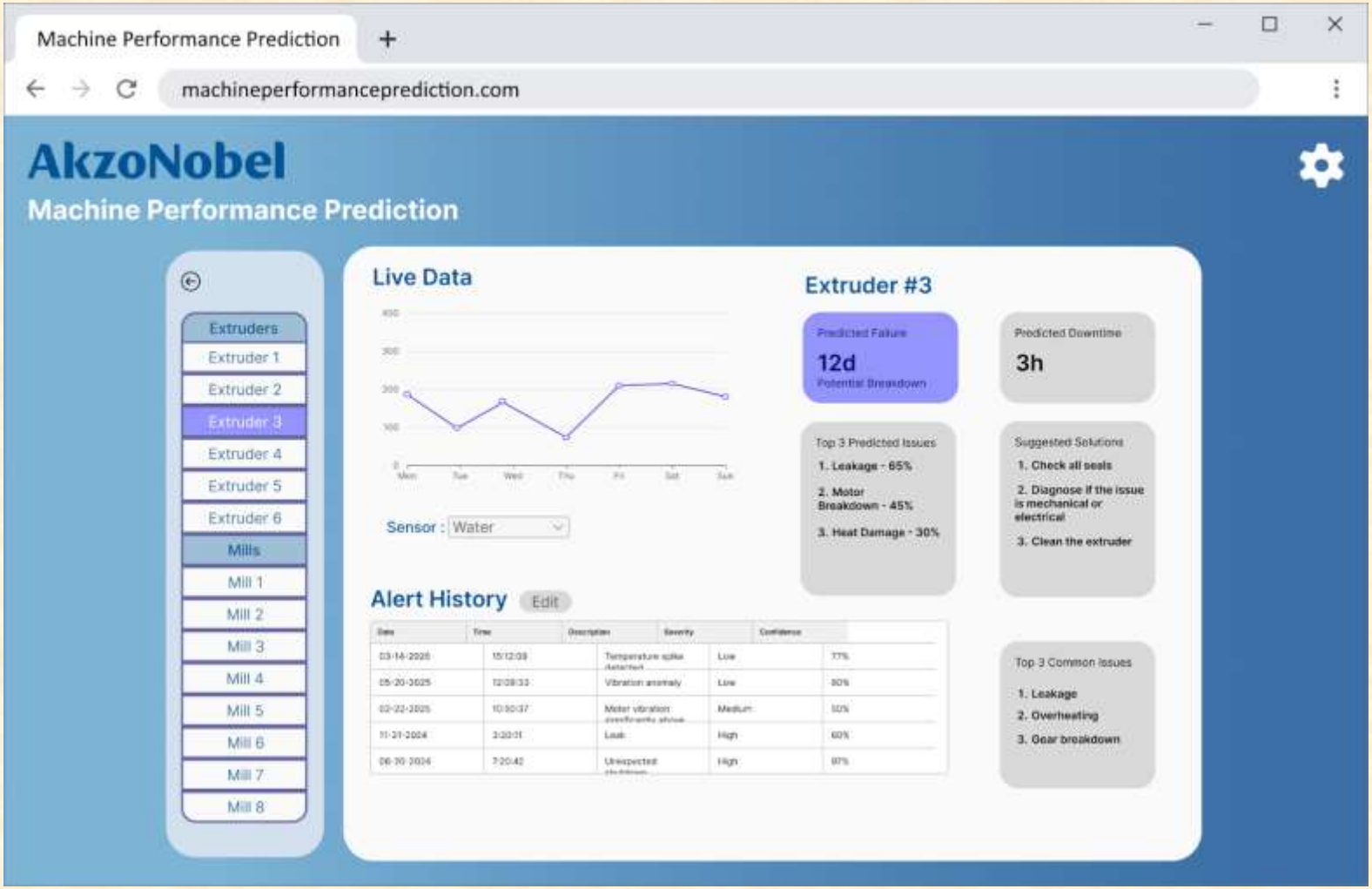
Project Design Specifications

- An accurate machine learning model with robust continuous learning to predict remaining useful life
- Informative dashboard that presents status of the factory floor
- Assertive alerts to grab the attention of an engineer

Screen Mockup: Dashboard



Screen Mockup: Machine



Screen Mockup: Mobile Dashboard



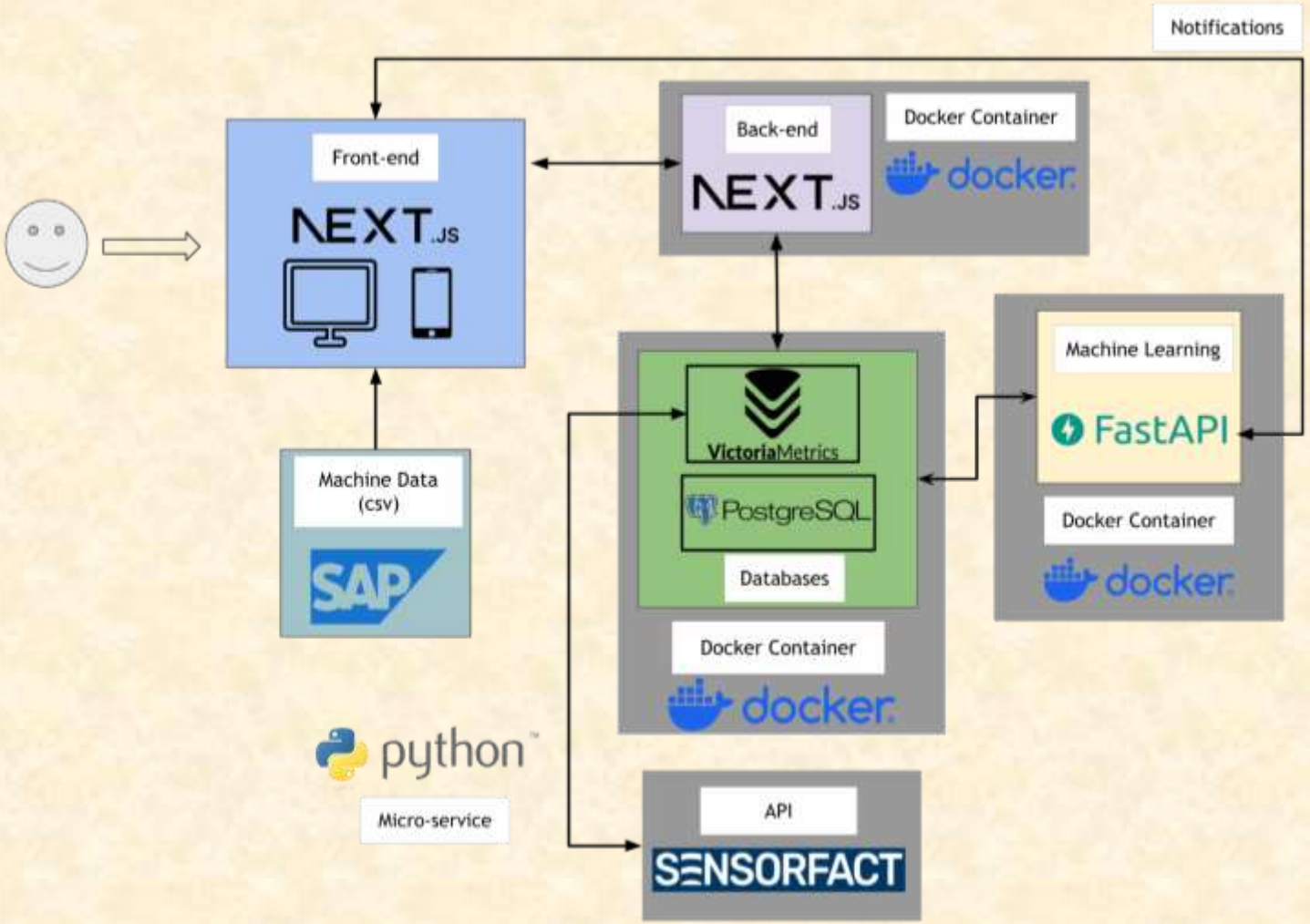
Screen Mockup: Mobile Machine



Project Technical Specifications

- A machine learning model will constantly monitor sensor data and make predictions on life expectancy
- When it forecasts a potential error, it will send a notification to the engineering team
- A responsive and performant dashboard will show performance and status in real time and alert the engineers appropriately

Project System Architecture



Project System Components

- Hardware Platforms
  - Sensorfact API
  - VictoriaMetrics
  - PostgreSQL
  - Docker
  - Better Auth
- Software Platforms / Technologies
  - Python
  - Fast API
  - Marimo/Polars/SciPy
  - JavaScript
  - Next.js



Project Risks

- Risk 1: Early-Stage Data Limitations
  - Not all sensors are installed; how can we train our model without data?
  - Add continuous learning / periodic retraining as more data accumulates and monitor for data drift to prevent performance degradation over time.
- Risk 2: Combining Multi-Sensor Data
  - Training a model on multiple sensors can produce data at different sampling rates, formats, and timestamps
  - We will align format when importing into VictoriaMetrics and use robust neural networks like LSTM
- Risk 3: Long-Term Maintainability
  - Limited IT staffing increases the risk that long-term maintenance for deployments, bug fixes, model retraining, and monitoring
  - Prioritize usability and reliability through thorough testing/debugging, clear error messages, and simple workflows
- Risk 4: Rate Limits for Sensorfact
  - Sensorfact is an external service and may enforce insurmountable rate limits
  - Bulk retrieve and store information into VictoriaMetrics to allow us to make as many API calls as we need

Questions?

