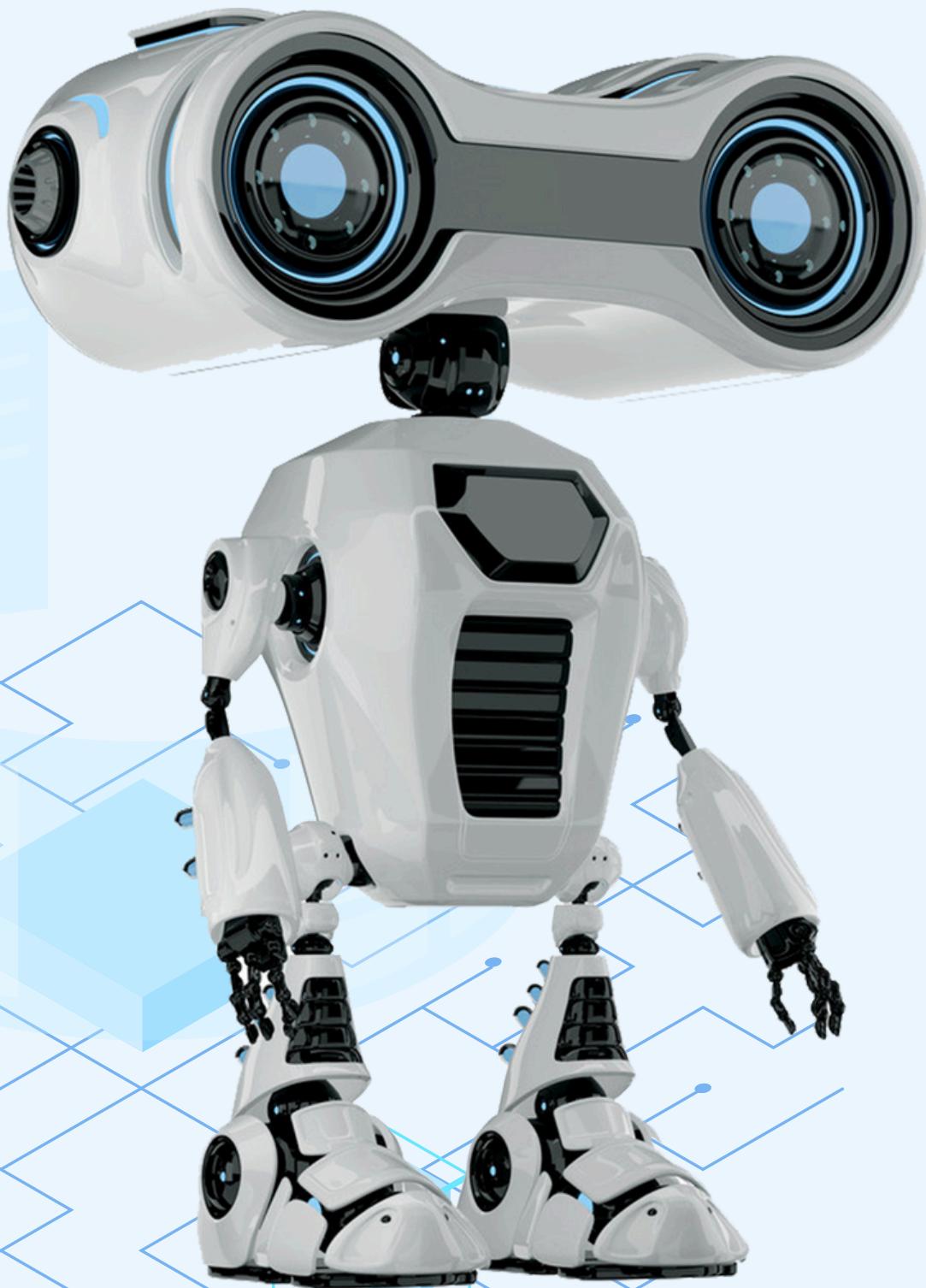


TATA INNOVENT HACKATHON



TEAM - WINZERS

Generative AI solutions for machine health monitoring, diagnostics and cognitive analytics

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Problem

Industrial machinery downtime leads to productivity loss and high maintenance costs. Need for real-time health monitoring, diagnostics, and predictive maintenance.

Market Size:

The global market for machine health monitoring is growing, driven by Industry 4.0 advancements. Estimated at several billion dollars in 2023, projected to grow significantly by 2030.

Objective:

Develop a generative AI solution for machine health monitoring, diagnostics, and cognitive analytics to improve machinery reliability and efficiency.

Approach:

Data Collection

Data Preprocessing

Feature Engineering

Model Development

Real-Time Monitoring

Predictive Maintenance

Continuous Improvement



Solution Overview

Data Collection:

Use IoT sensors to collect data (e.g., temperature, vibration, sound).

Data protocols: MQTT, OPC UA.

Data Preprocessing:

Clean and preprocess data using Python (Pandas).

Store and manage data using SQL.

Feature Engineering:

Extract meaningful features using Python (Scikit-learn).

Model Development:

Develop models using TensorFlow, PyTorch, Scikit-learn.

Focus on anomaly detection and predictive maintenance algorithms.

Real-Time Monitoring and Cognitive Analytics:

Implement real-time monitoring using SAS and R.

Use NLP techniques (SpaCy, BERT) for cognitive analytics.

Continuous Improvement:

Implement feedback loops for model retraining.

Use predictive analytics for ongoing improvement.



OUR DASHBOARD



Generative AI Solutions:

Data Synthesis:

Generate synthetic data to augment training datasets.
Simulate various failure scenarios for model robustness.

Advanced Predictions:

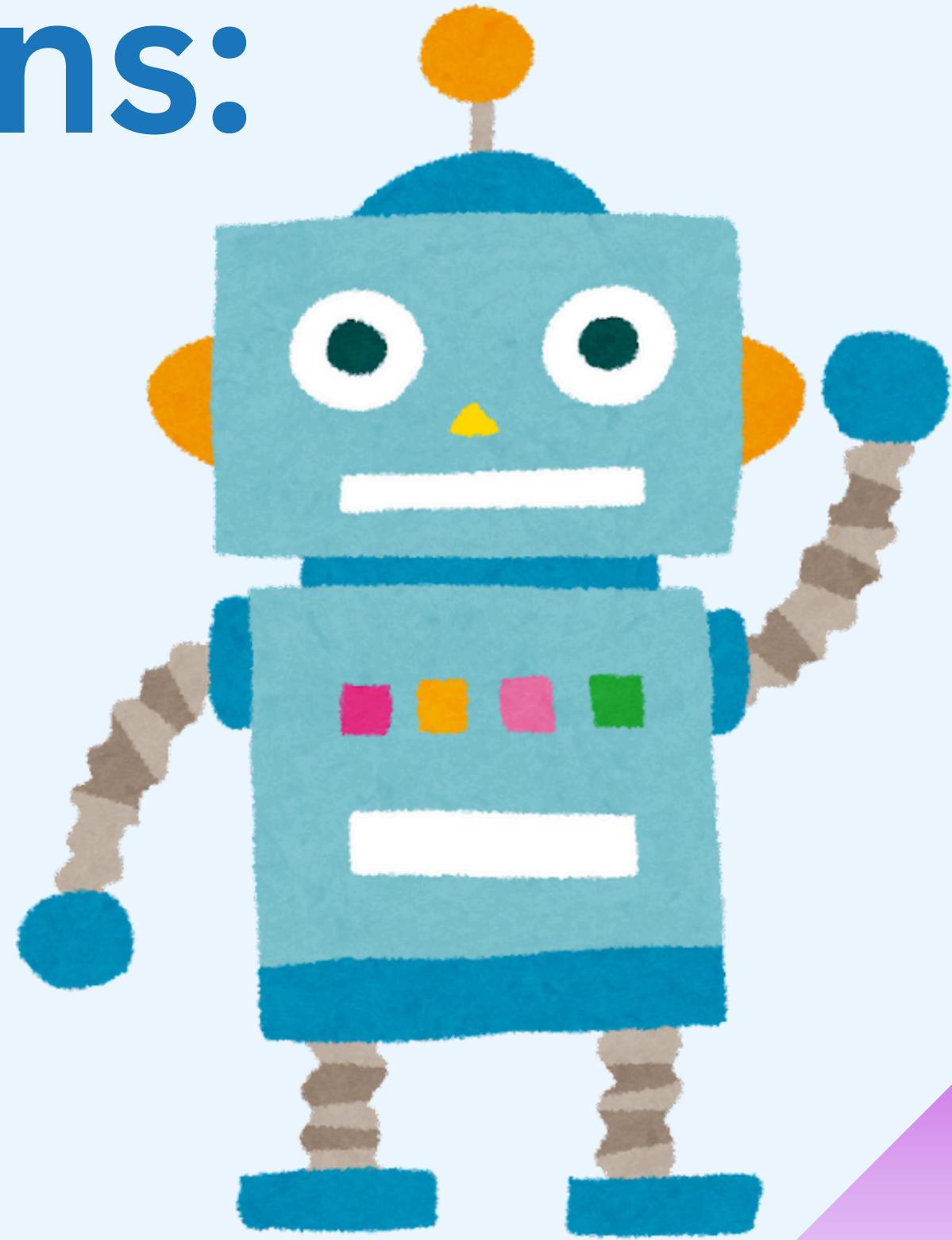
Use generative models to predict outcomes based on complex input data.
Analyze generated scenarios to forecast machine health.

Enhanced Diagnostics:

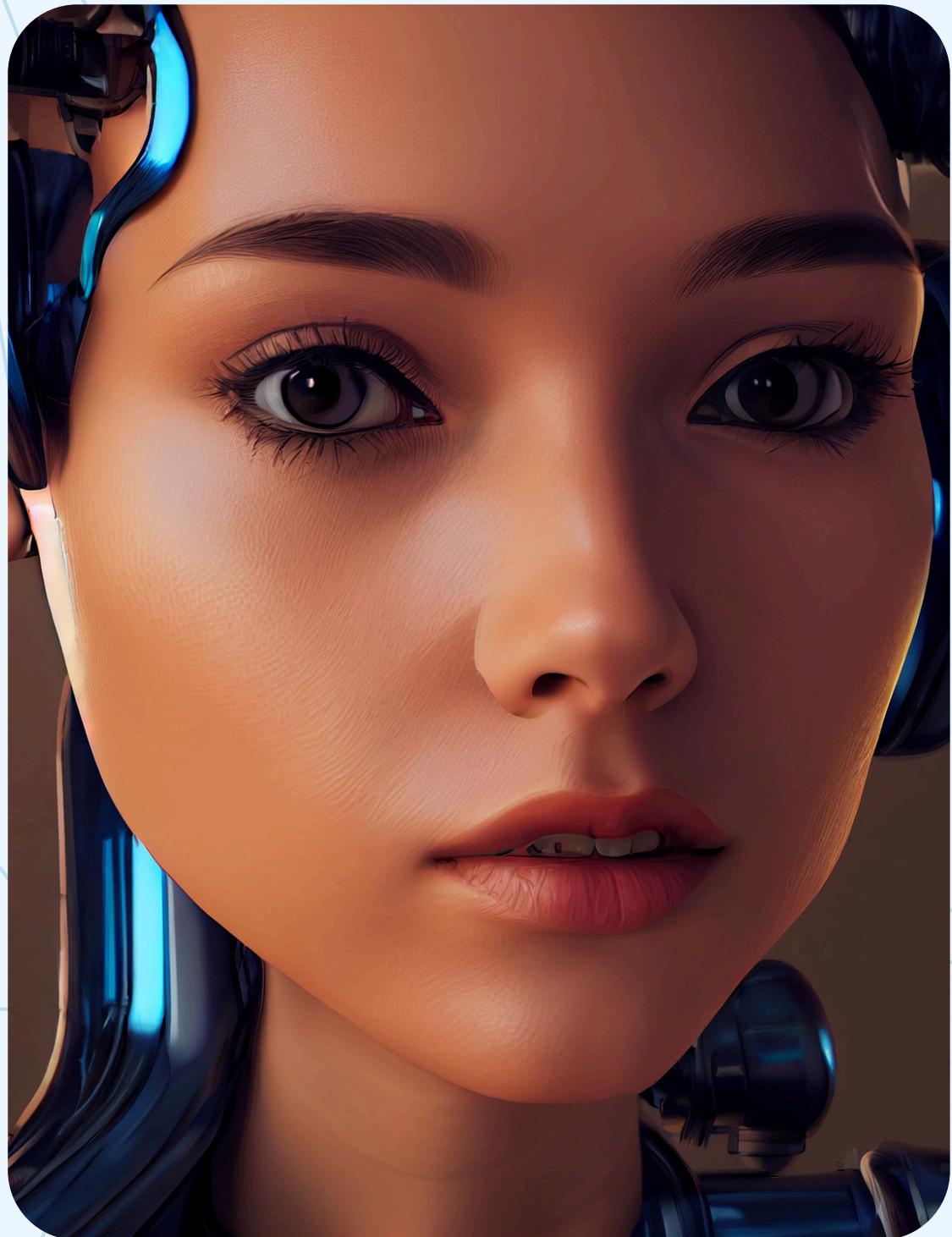
Create detailed diagnostic reports with generative models.
Develop conversational interfaces for interactive diagnostics.

Cognitive Insights:

Utilize AI to provide high-level contextual understanding.
Offer intelligent recommendations and optimizations based on generated insights.
These points outline the core steps for leveraging AI and generative AI in machine health management.



Challenges faced



Data Collection Challenges:

Ensure accurate and consistent data collection from IoT sensors.

Model Accuracy:

Develop models with high accuracy and low false positive rates.

Resource Constraints:

Develop the solution within the constraints of available resources (laptops and internet)

Technical Implementation

Technologies Used:

IoT Sensors: Data collection.

Python (Pandas, Scikit-learn): Data preprocessing and feature engineering.

TensorFlow, PyTorch: Model development.

SAS, R: Real-time monitoring.

NLP (SpaCy, BERT): Cognitive analytics.

Tools and Frameworks:

Use cloud services for scalability (e.g., AWS, Google Cloud).

Employ containerization (Docker) for consistent deployment.

Implement CI/CD pipelines for efficient development cycles.

Results & Achievements:

Expected Outcomes:

- Improved machinery uptime through predictive maintenance.
- Enhanced diagnostics and monitoring capabilities.
- Proactive decision-making through cognitive analytics.

Impact:

- Increased operational efficiency.
- Reduced maintenance costs.
- Higher reliability of industrial operations.

Future Enhancements:

Potential Improvements:

- Integrate more advanced AI techniques (e.g., reinforcement learning).
- Expand the solution to cover more types of machinery and industries.
- Develop a user-friendly dashboard for end-users (medical professionals, hospital staff).



THANK YOU!

