## Hackathon Track:

## "AI-Powered Smart Kitchen & Waste Minimizer for Restaurants"

**Objective:**

Develop an **AI-driven** system for **restaurant owners** that enhances kitchen efficiency through **computer vision**, **machine learning**, and **advanced analytics**. The platform will automate inventory tracking, predict food spoilage, optimize menus, and deliver actionable insights to reduce waste and increase profitability.

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## Challenge Statement:

**"Create an AI-powered Smart Kitchen System for Restaurants that uses computer vision and machine learning to automate inventory tracking, predict food spoilage, and optimize operations to minimize waste and maximize efficiency."**

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## 1. Computer Vision for Smart Inventory Management

- **Visual Inventory Tracking:** Use image recognition to identify and log ingredients (e.g., scanning kitchen shelves or refrigerator contents).
- **Real-Time Stock Detection:** Detect and track ingredient levels via camera feeds.
- **Food Spoilage Detection:** Use computer vision to identify spoiled or near-expiry ingredients.

**AI Models:**

- TensorFlow/YOLO for object detection.
- OpenCV for visual monitoring.
- AWS Rekognition or Google Vision API for pre-trained models.

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## 2. AI-Powered Demand & Waste Prediction

- **Sales Forecasting:** Predict ingredient consumption based on historical sales data and seasonality.
- **Waste Prediction:** Identify high-risk items prone to spoilage and overuse using machine learning.
- **Dynamic Inventory Replenishment:** Use AI to auto-suggest optimal stock levels, reducing over-purchasing.

**ML Models:**

- Time Series Forecasting (ARIMA, Prophet, LSTM) for demand prediction.
- Regression Models for Waste Forecasting.
- Reinforcement Learning for dynamic stock adjustment.

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## 3. Intelligent Menu Optimization

- **AI-Driven Recipe Recommendations:** Suggest daily specials using surplus or soon-to-expire items.
- **Cost Optimization:** Calculate real-time dish costs and suggest menu adjustments for profitability.
- **Custom Dish Creation:** Use generative AI to create new dishes based on available inventory.

**AI Models:**

- Natural Language Generation (OpenAI, Hugging Face) for dynamic recipes.
- Linear Optimization for cost calculation.

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## 4. Vision-Powered Waste Analysis & Reporting

- **Food Waste Classification:** Use vision models to categorize and log discarded food (e.g., over-portioning, spoiled items).
- **Waste Heatmap:** Visualize high-waste areas within the kitchen (e.g., specific stations or processes).
- **Loss-to-Profit Dashboard:** Quantify waste in financial terms to improve operational decisions.

**AI Models:**

- Image Segmentation (U-Net) for food waste identification.
- Computer Vision with YOLO for categorizing disposed items.

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## 📊 Suggested Tech Stack:

- **Frontend:** React (Web) or Flutter (Mobile).
- **Backend:** Node.js (Express) or FastAPI (Python for AI models).
- **Database:** PostgreSQL (structured data), MongoDB (for unstructured vision data).
- **AI/ML Frameworks:** TensorFlow, PyTorch, Hugging Face, OpenCV.
- **Vision APIs:** Google Vision, AWS Rekognition, OpenCV.

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## 🕑 Hackathon Timeline Expectation:

**Day 1:**

- Build core infrastructure (Inventory system, Image Capture pipeline).
- Integrate basic AI models (object detection for inventory).

**Day 2:**

- Implement demand forecasting & waste prediction.
- Build AI-based menu and recipe optimization.
- Develop waste tracking & reporting dashboard.

**Day 3:**

- Optimize and fine-tune AI models.
- Integrate advanced features (e.g., portion control, multi-modal analysis).
- Final testing and preparing live demo.

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## 🏆 Evaluation Criteria:

1. **AI Innovation:** Creative use of vision and machine learning to solve real-world problems.
2. **Business Impact:** Ability to reduce food waste and improve profitability for restaurant owners.
3. **Technical Depth:** Sophistication and accuracy of AI/ML models.
4. **Scalability:** Solution's ability to expand across multiple restaurant branches.
5. **User Experience:** Intuitive design for kitchen staff and managers.