Introduction

An exciting opportunity for innovative minds to revolutionize quality testing using camera vision technology for India's biggest ecommerce company. If you have a passion for technology and problem-solving, this is your chance to shine on a national stage.

Competition Overview

- **Objective**: Design a smart quality test system utilizing camera vision technology for India's leading ecommerce company. The system should be able to assess the shipment quality and quantity effectively and efficiently.
- **Target Audience**: Undergraduate students with a background in technology, computer science, engineering, or related fields.
- **Team Composition**: Students can participate individually or in teams of up to four members.

Why Participate?

- **Gain Real-World Experience**: Work on a real-world problem and develop solutions that can have a tangible impact.
- **Showcase Your Skills**: Present your innovative ideas to industry experts and gain recognition.
- **Networking Opportunities**: Connect with peers, mentors, and industry leaders.
- **Attractive Prizes**: Compete for exciting prizes, including cash awards and internship opportunities with leading companies.

Key Dates

- **Proposal Submission**: Oct mid (Date will be shared soon) Eliminatory Round
- **Final Presentation**: In person finale in Jan/Feb (Venue details will be shared with shortlisted teams from round 2)

Evaluation Criteria

- **Innovation**: Originality and creativity of the solution.
- **Technical Feasibility**: Practical implementation and technical soundness.
- **Impact**: Potential to improve quality testing processes in the grocery industry.
- **Presentation**: Clarity and effectiveness of the presentation.

GRID 6.0

Theme: Smart Vision Technology Quality Control

Smart vision technology to use advanced imaging systems and algorithms to capture and analyze visual information. In the context of quantity and quality testing, it helps automate the quality inspection process by identifying a product, its quantity and any defects or quality attributes.

Key Features of Smart Vision Systems:

1. Image Acquisition

- **Cameras**: High-resolution cameras are used to capture images of products.
- **Lighting**: Proper lighting conditions are essential for capturing clear images. Controlled lighting setups help minimize shadows and reflections that can interfere with image analysis.
- **Setup**: Cameras can be positioned on conveyor belts, shelves, or other strategic locations where they can capture images of products as they move through the inspection area.

2. Image Preprocessing

- **Normalization**: Adjust images for brightness, contrast, and color balance to ensure consistency across different conditions.
- **Filtering**: Apply filters to remove noise and enhance features of interest, such as edges or textures.
- **Segmentation**: Divide the image into meaningful regions, such as separating the product from the background.

3. Feature Extraction

- **Text Detection and Recognition:** Use OCR algorithms to detect and extract text from the image. to identify product names, descriptions, serial numbers (EAN), and other text-based details ie, Label and MRP attributes
- **Feature Analysis**: Detect geometric features like edges, contours, and shapes to identify deformities or size inconsistencies, color patterns and variations to detect freshness, or spoilage or surface textures to identify bruises, wrinkles, or other surface defects.
- **Object Detection**: Apply object detection algorithms to identify a product from its **shape,Count, size, color** and other attributes that are unique design elements

4. Classification and Decision-Making

- **Machine Learning Models**: Train machine learning models to recognize and classify products based on the extracted features and text. Use trained models to classify products

based on extracted features. Common models include convolutional neural networks (CNNs) and support vector machines (SVMs).
- **Product Database**: Compare the detected features and text against a database of known products to identify the product accurately.
- **Deep Learning**: Use deep learning models to enhance the accuracy of detection and classification. These models can learn from large datasets and improve over time.

5. Output and Feedback

- **Product Identification:** Once the product is identified, display relevant details such as product name, price, and specifications.
- **Real-Time Feedback**: Provide immediate results to operators or automated systems for rejecting defective/wrong products.
- **Data Logging & Feedback Loop:**: Record data for quality control analysis, tracking trends over time, and improving processes. System needs to be built to improve its accuracy through continuous learning process

6. Integration with Existing Systems

- **Automation**: Integrate with conveyor belts, robotic arms, or sorting machines for automated handling based on quality assessments.
- **Data Systems**: Connect to inventory and management systems to update records and generate reports.

Applications in the ecommerce Industry

1. **Item Recognition:** Identification of the unique product, category and count/Nos
2. **Packaging Inspection**: Recognition and verification the integrity and correctness of packaging/labeling (P0)
3. **Expiration Date Verification**: Recognize printed expiration dates to ensure products are fresh.
4. **Fresh Produce Inspection**: Automatically assess the quality of fruits and vegetables by detecting defects, discoloration, or irregular shapes. (P0)
5. **Bin Monitoring**: Monitor stock and ensure products are placed correctly in inventory bins

Challenges in Implementing Smart Vision

- **Environmental Conditions**: Lighting and background can affect image quality.
- **Complexity of Products**: Variability in size, shape, and color can complicate analysis.
- **Cost and Integration**: Balancing technology costs with benefits and integrating with existing systems.

Expected Outcomes from Participants

Participants are encouraged to develop innovative solutions that address these challenges and leverage smart vision technology to enhance quality testing processes. Consider the following aspects when designing your solution:

- **Accuracy**: Ensure the system can accurately detect and classify quality attributes.
- **Efficiency**: Minimize processing time to keep up with high-volume operations.
- **Cost-Effectiveness**: Propose solutions that are affordable and scalable.
- **User Experience**: Design systems that are easy for staff to operate and understand.

Event Format and weightage

To make the competition more engaging and focus on solving real-world problems with deployable solutions, GRID 6.0 has provided a list of use cases that can be addressed using cameras and computer vision. Each use case carries a different weight, and participants are required to select at least three use cases, ensuring they solve for at least 50% of the total weight to qualify for consideration in the next round.

Sl no	Use case	Weightage	Use case	Example	Comments
1	OCR to extract details from image/label	20%	Extracting details available on packaging material	Use of OCR to read brand details, pack size, brand name etc	Participating teams to train the model to read details from different range of products, not restricted to **FMCG** but also, - **OTC items** health supplements,skin care and personal hygiene items, - **Personal care items** like deodorants, lipstick, face screen shampoo etc. - **Household items like** cooking oil, Toiletries,package food items
2	Using OCR to get expiry date details	10%	Expiry date validation	Use OCR to get expiry and MRP details printed on items.	
3	Image recognition and IR based counting	30%	Brand Recognition and count confirmation using IR	Use Machine learning capabilities to teach the system to recognise the brand, count the nos and other details from image	
4	Detecting freshness of fresh produce	40%	Predicting shelf life of fresh fruits and vegetables	Assess the freshness of fruits and vegetables by analyzing various visual cues and patterns	Participating teams need to train the model on fresh fruits and vegetables and other perishable items like bread etc

The event aims to challenge participants to solve real-world problems through a series of stages, starting from an online quiz and progressing through proposal submissions and live

demonstrations. Each stage will test the participants' analytical skills, creativity, and ability to develop practical solutions.

Stage 1: Elimination Round

Format:Online Quiz

- Participant teams will appear for an online screening test.
- The quiz will consist of objective-type questions designed to evaluate participants' analytical skills and business acumen.
- This stage will act as an elimination round, filtering teams for the next stage.

Teams with the highest scores will move on to the Proposal Round.

Stage 2: Proposal Round

Format:Use Case Submission & Code Review

- Selected teams will submit detailed use case scenarios they plan to solve.
- The submission should include a proposal outlining their approach and the code developed so far.
- GRID team to provide a set of images to the participating teams for testing the model
- Since this is an elimination stage, participants are encouraged to submit a video simulation of their solution on the image set provided to them, ensuring that they can clearly articulate what they have solved. Teams who have chosen to work on detecting freshness of produce, may choose any fresh fruit/vegetable/bread etc and submit the freshness index based on the model
- The video will help demonstrate the effectiveness of their approach and provide a visual representation of their solution.

Teams with the most comprehensive and innovative proposals will proceed to the final stage.

Stage 3: Solution and Demo Round

Format: Live Demonstration

- The remaining teams will be invited to present a live demo in front of a jury.
- The demo should showcase the use case solution in a real-world scenario.
- The jury may ask participants to perform actions live, testing the robustness and functionality of their solutions under real conditions.
- Teams should be prepared to answer questions and demonstrate their solution's impact and practicality.

The jury will evaluate the solutions based on innovation, effectiveness, and execution, and the best-performing teams will be declared winners.

Judging parameters

This event plan is designed to challenge participants while providing them with opportunities to showcase their skills across multiple stages. Each round progressively tests their ability to think critically and deliver impactful solutions.

- **Clear Image Extraction:** Ensure that your solution achieves high-quality image extraction, particularly when using OCR, to capture accurate details and improve overall performance.
- **Light Balancing and Noise Reduction:** Focus on optimizing light balance and reducing noise in images to enhance clarity and accuracy in your solution. This will help improve both the visual quality and the effectiveness of computer vision algorithms.
- **Maximize Weightage:** Prioritize solving higher-weighted use cases to boost your chances of success. Focus on those that contribute the most to the overall score.
- **Innovation and Impact:** Develop solutions that are not only innovative but also have practical, real-world applications.
- **Clear Communication:** Ensure your proposals and demos are clear and well-structured. Use visual aids like simulations and live demonstrations to effectively present your solution.
- **Collaboration:** Teamwork and communication are essential, especially in the Proposal and Demo Rounds. Leverage each team member's strengths to enhance your overall solution.
- **Technical Excellence:** Teams will be judged on creativity, technical proficiency, and problem-solving skills. Strong technical execution is crucial, but the ability to clearly explain your solution to the jury is equally important.