HackMTY 2025 – Pick & Pack of the Future
Pillar: *Smart Execution*

Real-Time Error Detection

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gategroup

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1. Understanding the Context

In airline catering, thousands of items are prepared, packed, and dispatched every day to serve passengers on hundreds of flights. Each item must be placed in the correct position within drawers, trolleys, or containers according to the airline's service plan. These assemblies take place under strict time pressure, with employees handling dozens of different product types, quantities, and configurations in just a few minutes.

The process depends heavily on precision. Every trolley must contain the exact products and portions required for that specific flight, no more and no less. Each item has a defined location, quantity, and sometimes even a labeling or temperature rule that must be followed precisely. Because of this, catering can be compared to a large-scale manufacturing line where accuracy and timing are both critical to ensure on-time performance and customer satisfaction.

Most of these assembly tasks are still performed manually. Operators follow printed specifications, pick items from storage areas, and place them into trolleys or drawers based on their training and visual reference. After the packing step, a quality check is performed before sealing, but this verification is usually limited to a quick visual confirmation. It focuses on obvious aspects such as completeness, seal condition, or labeling, without checking every product or drawer position in detail. This means that subtle mistakes can still pass unnoticed even after the QC step.

Typical errors can include loading the wrong beverage type, missing an item, mislabeling a trolley, or sealing it with the wrong flight number. Some of these errors are detected later at the airport or even on board when the crew opens the trolley. At that point, correction is no longer possible, and the incident may lead to passenger complaints, stock losses, or additional handling costs on the next return.

Such mistakes rarely happen out of negligence; they occur because employees are working in high-speed environments with many similar-looking items and minimal room for error. Fatigue, repetition, and distractions can easily cause a mix-up between products, drawers, or flights. Even with the existing QC step, the absence of deep verification means that many inconsistencies remain invisible until the trolley has already left the catering unit.

In large catering operations, hundreds of drawers move simultaneously through preparation, assembly, and dispatch areas. Each one must follow a defined

specification, but the moment something goes wrong, such as a wrong label, an incorrect product, or a missing item, the problem often goes unnoticed until much later. This delay in detection consumes valuable time and resources when rework or replacements are required.

Real-time error detection aims to change this by introducing intelligent systems that can identify mistakes instantly while the work is still in progress. Whether through computer vision, sensors, or data-driven validation, the objective is to transform quality assurance from a superficial final check into a continuous and proactive safeguard that prevents errors before they leave the facility.

2. The Current Challenge

In every airline catering operation, products and equipment must be assembled, labeled, and dispatched with absolute accuracy. Each flight has a specific configuration that defines exactly which items must be included, in what quantity, and in which position. This applies to meals, beverages, cutlery, service items, and even decorative elements for premium classes. When hundreds of flights are prepared every day, the potential for small human errors increases significantly.

Today, quality control during assembly still depends largely on human verification. After the packing stage, a quality check step is performed before sealing. This check focuses on visible and high-level aspects such as completeness, labeling, and trolley condition. However, it is typically done under time pressure and without inspecting every drawer or verifying each product. As a result, many smaller mistakes, such as incorrect placements or swapped items, remain undetected.

Common types of errors include incorrect product combinations, missing components, wrong flight or class labeling, and sealing or loading mistakes. For example, an economy trolley might be packed with a premium wine, or a label could show the wrong destination. In other cases, a product might be placed in the correct trolley but in the wrong drawer. While these issues may seem minor, their consequences can be significant. They can lead to passenger dissatisfaction, additional handling at the destination, or safety and compliance concerns when products are routed incorrectly.

Because production teams work under constant time pressure, their main focus is to complete the required quantities and meet departure deadlines. A single employee can assemble hundreds of drawers in one shift, often dealing with repetitive layouts and similar-looking products. Even highly experienced operators can make small errors when fatigued or distracted, especially during peak flight waves or last-minute changes.

Supervisors rely on the quality check step to confirm the readiness of trolleys, but the verification process is mostly visual and limited by available time. Once a trolley is sealed and moved to dispatch, it is rarely re-opened unless a major issue is reported. This

means that once an error passes this checkpoint, it travels through the entire system unnoticed. By the time it is discovered, usually on the aircraft or upon return, correction is no longer possible.

Another challenge is the lack of real-time traceability. When an issue is reported, it is often unclear which employee handled the trolley, which workstation was involved, or exactly when the mistake occurred. Without this visibility, root cause analysis becomes difficult, and recurring errors cannot be effectively addressed. Most catering units still depend on manual checklists or isolated digital tools that do not capture live process data or provide automated alerts.

This results in a reactive approach to error handling. Teams only become aware of mistakes after the problem has already reached the customer or caused an operational disruption. The process then requires investigation, rework, and additional communication between departments, consuming time and resources that could have been avoided with earlier detection.

A real-time error detection system could fundamentally change this dynamic. By integrating intelligent tools directly into the packing or sealing stages, it would be possible to detect inconsistencies at the exact moment they occur. Such systems could verify each action automatically, guiding operators with instant feedback and preventing errors before they leave the facility. This would allow airline catering units to evolve from static quality checks to continuous, proactive control, ensuring accuracy, efficiency, and trust in every step of the operation.

3. Your Mission

Your challenge is to imagine how technology could transform the current manual and superficial quality check process into a smarter, faster, and more reliable system that detects mistakes in real time. The goal is to ensure that every trolley leaving the catering unit matches its specification perfectly, reducing errors, rework, and downstream disruptions.

You are invited to design a solution that supports catering teams during the packing or sealing process by identifying deviations as soon as they happen. The system should help employees confirm that the correct items are placed in the right position, that labels correspond to the right flight, and that all elements are complete before sealing. Instead of verifying accuracy only at the end, your concept should enable continuous validation throughout the process.

Your idea can combine any technologies or approaches that enable instant detection or feedback. These could include computer vision, barcode or QR validation, sensors that measure quantity or weight, or digital workflows that compare real-time inputs with

predefined specifications. What matters most is that your solution helps employees correct issues immediately while maintaining the required operational speed.

You can also explore upstream or integrated concepts that improve the flow of information between packing, quality check, and dispatch stages. For example, data from scanners or cameras could be automatically linked to production records, creating a digital trace of each trolley's assembly. This would allow supervisors to identify where errors happen most frequently and take preventive action.

In scope:

- Real-time detection of errors during packing, labeling, or sealing
- Smart systems or devices that alert operators to incorrect or missing items
- Automated validation of flight labels, product codes, or quantities
- Integration of quality feedback into digital dashboards for supervisors
- Upstream traceability improvements that help prevent repeated mistakes

Out of scope:

- Changes to menu composition, recipes, or airline specifications
- Altering staffing structures or introducing punitive monitoring systems
- Full automation or robotics replacing human workers

You do not need to design a full production line or enterprise platform. A focused concept, prototype, or mock-up is enough to demonstrate how real-time detection could function in a real catering environment. The emphasis is on practicality, usability, and the ability to make quality assurance a continuous process instead of an afterthought.

4. Inspiration and Example Ideas

There are many possible ways to approach this challenge. The most successful ideas will combine technology, process understanding, and creativity to make airline catering more accurate and efficient. Below are a few examples to inspire your thinking. You can use them as a starting point, adapt them, or create your own concept from scratch.

a. Computer vision assistant

A camera or tablet-based system that recognizes the layout of drawers or trolleys and compares them with digital references. As employees place items, the system automatically checks whether the correct product is in the right position. If

something is missing or misplaced, a visual or audio alert is triggered. This reduces manual verification and ensures consistency even under time pressure.

b. Barcode or QR validation tool

A smart scanning station where every product or label is scanned and automatically verified against the flight specification. The system confirms that all components match the plan before sealing. If an incorrect item or label is detected, it blocks the sealing step and alerts the operator to fix the issue.

c. Sensor-enabled workstations

Packing tables or trolleys equipped with sensors that detect weight, movement, or RFID tags. These sensors confirm that the right number of items has been placed and that nothing is missing. For example, a small light could turn green when the correct setup is completed, guiding the operator step by step.

d. AI-based validation dashboard

A digital dashboard connected to all packing stations that monitors accuracy rates in real time. It collects data from scanners, sensors, or cameras and highlights any deviation immediately. Supervisors can see which station or product category is causing repeated errors and adjust workflows or training accordingly.

e. Voice-guided or augmented reality support

A headset or AR display that assists employees during packing. The system provides voice prompts or visual overlays indicating where each product should go and confirms each step automatically. This can reduce cognitive load and help new employees reach accuracy faster with less supervision.

f. Integrated traceability and feedback platform

A software solution that links the data from packing, quality check, and dispatch into one continuous trace. Each trolley or drawer receives a digital record of its assembly history. When a deviation occurs, the system logs it instantly and feeds the information back into the process for analysis. Over time, this creates a self-improving quality loop that reduces repeated errors.

A strong idea does not need to rely on complex or expensive technology. Even simple, well-designed digital aids that provide instant feedback can make a big difference in a fast-paced environment. The key is to focus on usability, speed, and reliability, ensuring that employees can work confidently while maintaining perfect accuracy.

5. Supporting Mock Data

To help you design and test your ideas, you will receive a dataset that simulates continuous live readings from packing and quality control stations. Unlike static reports, this dataset represents the kind of real-time data a connected workstation could generate if it were equipped with scanners, cameras, or sensors. It allows you to experiment with how live feedback and error detection could be implemented in a catering environment where mistakes must be identified instantly.

Currently, airline catering operations do not collect structured data on packing accuracy in real time. For such a system to exist, a **data-capture layer** must first be established. This layer would automatically collect information as employees perform their work, using a combination of simple and smart technologies such as:

- Vision-based monitoring that uses cameras or depth sensors to verify drawer layouts or product types.
- Barcode, QR, or RFID scanning to confirm the correct item, label, or trolley ID.
- Smart scales or weight sensors to check expected quantities or detect missing items.
- Proximity or motion sensors that register drawer movement or sealing actions.
- Manual confirmation inputs such as buttons, screens, or light signals that operators trigger after completing a verified step.

All these sources would send continuous data points to a local system or cloud platform, where the readings are compared with predefined specifications for each flight. Whenever a deviation is detected, the system immediately generates an alert and logs the event.

The dataset provided in Excel illustrates how these live readings could look once captured. Each line represents a real-time event, showing which station produced it, what sensor or source was involved, and whether an error was found.

Column	Description
Stream_ID	Unique identifier for the live data feed from a specific workstation. Example: PK01_STREAM.
Timestamp	Exact time when the data point was captured.
Station_ID	Workstation or area generating the signal. Example: PK01, QC02.

Drawer_ID	Identifier for the drawer being packed or inspected. Example: DRW_014.
Spec_ID	Digital identifier linking the reading to the expected flight or customer specification. Example: SPEC_20251013_01.
Sensor_Type	Type of device or source generating the reading, such as Camera, Barcode, RFID, or Scale.
Expected_Value	The reference value defined in the specification, such as the correct product code or expected weight.
Detected_Value	The actual reading captured by the sensor or scanner.
Deviation_Score	Numeric value between 0 and 1 indicating the difference between expected and detected input.
Alert_Flag	Indicates whether the reading is normal ("OK") or triggers a warning ("Alert").
Operator_ID	Identifier of the employee handling the task at that moment. Example: EMP032.
Flight_Number	Flight associated with the activity. Example: LX065, EK088.
Customer_Name	Airline customer linked to the flight. Example: Swiss International Air Lines, Emirates.

This mock dataset simulates how multiple data sources could interact in a live production environment. You can use it to:

- Build dashboards that visualize alert frequency by sensor, station, or operator.
- Model how deviations accumulate over time and identify recurring error types.
- Create prototypes that react to live alerts, such as visual or sound notifications.
- Design data architectures showing how raw sensor input becomes actionable insight.

Using the dataset is optional. You may also approach the challenge from another angle, such as proposing how sensors, cameras, or software could collect and process this information. Participants are encouraged to **review, modify, or expand the dataset** by adding or removing fields that they believe are essential for making the system work effectively. The goal is to identify **what data truly matters** for detecting and preventing

errors in real time and to show how it can be captured and used to create a continuous flow of operational insight.

By transforming each workstation into a live data source, catering units could move from reactive inspection to proactive prevention, ensuring that every trolley leaving the facility is assembled accurately, efficiently, and safely.

6. What Makes a Great Solution

Judges will evaluate your project based on several key dimensions that reflect both creativity and operational relevance. Your idea does not need to be perfect or fully functional, but it should clearly demonstrate how technology could realistically enable real-time error detection within a busy airline catering environment.

a. Innovation

How original and creative is your solution? A strong proposal introduces a new way of ensuring packing accuracy or visual verification that goes beyond the current manual quality check. Innovative ideas may combine sensors, computer vision, or data logic in unexpected but practical ways. Judges will value solutions that transform traditional inspection into an intelligent, continuous process that detects issues the moment they occur.

b. Feasibility

Could your solution work in a real catering facility where employees are constantly under time pressure? Consider environmental factors such as lighting, noise, hygiene, and space limitations. The best solutions are those that can be implemented with minimal disruption to existing workflows while integrating smoothly with current packing and sealing processes. Demonstrating how your idea could scale across stations or facilities will further strengthen its feasibility.

c. Efficiency

Does your idea make the process faster, more reliable, or less dependent on manual verification? Efficiency is key in catering units that operate on tight schedules. Great solutions will either reduce rework, shorten quality checks, or eliminate the need for repetitive human inspection. The more your concept helps employees focus on value-adding work rather than correction, the higher it will score.

d. Sustainability

How well does your solution contribute to sustainable operations? Every prevented error reduces unnecessary waste, re-packing, and product loss. By improving accuracy at the source, catering units can avoid discarding food, materials, and

packaging caused by assembly mistakes. A sustainable approach also includes energy-efficient devices, reusable infrastructure, or processes that lower the overall environmental footprint.

e. User Experience

Is your solution intuitive and supportive for catering employees? Keep in mind that users work in fast-paced environments, often with gloves and limited interaction time. Systems that use clear visual cues, voice prompts, or simple automated feedback will be much easier to adopt. A great user experience makes technology feel like a helpful assistant rather than a control mechanism, empowering employees to perform their work confidently and accurately.

A great solution is one that balances innovation with practicality. It does not need to be complex or expensive but must demonstrate a clear understanding of the operational context and the human element behind the process. The most impactful ideas will be those that turn error detection into a natural, seamless part of everyday work, helping catering teams achieve precision, consistency, and trust at every step of production.

7. Real-World Impact

Implementing real-time error detection could significantly improve the quality, reliability, and efficiency of airline catering operations worldwide. Each day, thousands of trolleys and drawers are assembled under intense time pressure. Even minor mistakes can lead to product losses, customer complaints, or additional handling at the destination. By detecting these issues instantly instead of after dispatch, catering units could prevent errors before they cause disruption.

A live detection system could allow employees to receive immediate feedback while packing, ensuring that every item, label, and drawer matches the correct flight specification. Supervisors would no longer need to rely on random or superficial checks. Instead, they could monitor a live dashboard showing all stations in real time, instantly identifying when and where a deviation occurs. The system could then alert the operator to correct the issue on the spot, saving both time and resources.

Over time, the collected data would also provide valuable insight into recurring errors and performance trends. Managers could identify which products, shifts, or stations generate the highest number of deviations and focus training or process improvements accordingly. The continuous flow of information would make quality assurance proactive and data-driven, transforming inspection from a reactive control into an integrated part of production.

The operational benefits would be substantial. Reduced rework, lower product waste, and faster turnaround times would directly impact productivity and cost efficiency. More

importantly, airlines would receive consistently accurate setups, improving customer satisfaction and trust in service quality. With fewer in-flight errors, catering teams could focus their attention on productivity, hygiene, and service readiness instead of last-minute corrections.

Beyond airline catering, the same principles could be applied to many other sectors that depend on precision and speed. Logistics centers, hospital pharmacies, industrial assembly lines, and food packaging facilities all face similar challenges in detecting mistakes early. Real-time error tracking could help these industries reduce waste, improve safety, and achieve consistent output at scale.

By designing an intelligent and feasible solution for real-time error detection, participants have the opportunity to shape the future of operational excellence in catering. Your concept could inspire the next generation of smart workstations, automated quality systems, and data-driven production environments, creating measurable impact not just in aviation but across global supply and manufacturing ecosystems.

8. Tip for Participants

Think of this challenge as building the eyes and ears of a modern catering operation. The goal is not to replace people but to empower them with intelligent systems that detect and prevent errors before they happen. Real-time error detection is about creating visibility at the exact moment when accuracy matters most, during packing, sealing, and dispatch.

Try to visualize the actual environment in which your solution would work. Employees move quickly between packing stations, handling hundreds of products every hour while following strict specifications and time limits. In this setting, your idea should integrate naturally into the workflow, helping operators make instant corrections without slowing them down. A flashing light, sound signal, or on-screen alert can sometimes be more effective than a complex system if it delivers feedback at the right time.

Focus on designing technology that adapts to the user, not the other way around. Consider how the system could simplify the employee's task by reducing guesswork and increasing confidence. Think about how it could communicate deviations clearly through visuals, colors, voice, or data and how it could escalate issues to supervisors when manual intervention is needed.

Be creative and practical at the same time. You are free to explore different angles such as sensor-based detection, smart surfaces, computer vision, or data integration platforms. You can even rethink what kind of data should be collected in the first place. Sometimes identifying which signals truly matter can be more valuable than building a fully automated prototype.

Remember that the best solutions are often simple, elegant, and deeply aligned with real operational needs. A small but well-designed idea that prevents just a handful of mistakes every day could save hundreds of work hours and significantly reduce waste across global operations. Real-time error detection is about making accuracy effortless, turning quality assurance from a final control step into a living, intelligent part of daily work.