Universidad Isabel I

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Project Submission Guidelines

- **Documents:**

  - **For your final project, you will need one document:**

    - The "Answer Template," which you can download from Campus. This is the document where you will submit only your answers.

- **Submission:**

  - Upload the document with your answers to Campus in .docx format.

- **Original Content:**

  - Ensure that all content is original and created by you.

- **Document Format:**

  - The maximum length of the work is approximately 18 pages, not including appendices, which must also be submitted in .docx format.

- **Important:**

  - Plagiarism is prohibited and may result in ineligibility to receive your degree.

  - Follow these instructions carefully

Evaluation

The final project will be evaluated based on the following criteria:

- Analysis and decision-making (5 points): This criterion evaluates the student's ability to analyze the presented case and make well-founded strategic decisions. Maximum points are awarded for deep and detailed analysis that clearly identifies key issues, evaluates available options, and justifies decisions with logical and practical reasoning. The student is expected to demonstrate a thorough understanding of the case and use a systematic approach to solve complex problems.

- Application of theoretical concepts (3 points): This criterion assesses how effectively the student applies theoretical concepts learned in the course to the case analysis. Maximum points are awarded when relevant theories, models, and principles are accurately and effectively integrated into the analysis and proposed solutions. It is crucial that the student shows a deep understanding of theoretical concepts and can apply them practically and pertinently to the situations described in the case.

- Originality and innovation (2 points): This criterion evaluates the creativity and originality in the student's responses. Maximum points are awarded for innovative solutions and original perspectives that demonstrate critical and creative thinking. Fresh ideas that go beyond conventional answers are valued, showcasing an ability to think outside the box and offer new and effective approaches to solving the problems posed in the case

Background

A new airline is born in Great Britain with the intention of being competitive in the sector from the start. Due to current fuel prices and crises stemming from a war in Europe, it cannot compete on price. Moreover, it receives support from official bodies, so flight prices are very similar to those of the competition.

Therefore, it must attract users from another point of view. The company's board of directors decides they need to be the number one company in punctuality.

Like all airlines, this one has a limited staff, so the crew of one flight is the same as for another flight on a different route, meaning the plane can't depart until the previous flight has arrived. Additionally, crew rest protocols must be adhered to.

But that's not all; there are operators who must perform maintenance functions, refueling, cleaning, passenger boarding, luggage loading, etc., so delays in some of these actions could cause flight delays, preventing the company from meeting its self-imposed punctuality standards.

The board assigns a young telecommunications engineer, Emily, to develop a master plan that identifies areas where the company can improve its punctuality compared to the competition, making it a first choice among users.

This young engineer, recently graduated, spent her summers in Spain and had friends who had created a startup that was bought by Iberia. This startup solved the problem of labels that deteriorated or were tampered with by users, utilizing AI-based technology through computer vision (known as the "Vision Tech AI"), which can read any alphanumeric system no matter how deteriorated it is. Taking advantage of the fact that the airline was part of a holding company with a Spanish one, she decided to seek collaboration with this small Spanish firm.

The proposal Emily brought to the airline's Board of Directors earned her a substantial salary increase and more responsibilities within the company. The plan was so well received that it was implemented immediately, and the company became the world leader in punctuality, with its Spanish "sister" surprisingly in second place. The plan involved implementing AI technology at all levels.

A 17-point plan was created, which the operators in charge of preparing the planes had to follow. Using sensors in the work areas, information was received about the time operators needed to perform their tasks, allowing for accurate flight scheduling. The system detected if there was a possible risk of task time overruns and alerted a supervisor in advance.

Moreover, AI technology was implemented in other sectors, such as customer service, boarding system, check-in, luggage distribution, post-sale service, etc.

Resolve

Questions:

1. The operators had to fill out a short form about their activity each time they completed a task. A network of cameras was installed in the work environment. How can Artificial Intelligence analyze whether an operator who has completed their task but hasn't filled out the report is not treated as a problem overall?

2. The "Vision Tech AI" system can read any alphanumeric label no matter the state it is in. But how can it achieve this? Could it read a label that is missing some characters?

3. What role would Artificial Intelligence have in an assistant in a customer service center? Could it sell a ticket?

4. How can Artificial Intelligence help in passenger boarding?

5. One option of the plan was to include a humanoid robot in Heathrow Airport. How could this help with flight punctuality? Could users from other companies use the robot's services? Could the robot hold a conversation with the user to meet their requests?

Instructions:

Write your answers to each question of the exam in the space provided below.

Please, do not copy the exercise questions into your answers.

Number each answer according to the number of the corresponding question.

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Introduction

The airline industry is one of the most complex operational environments in the world. Punctuality is not a single-variable problem; it is the result of tightly coupled processes involving humans, machines, infrastructure, regulations, and unpredictable external factors. In the presented case, a newly created airline in Great Britain faces a strategic constraint: it cannot compete on ticket price due to fuel costs and geopolitical instability, and public subsidies make prices similar across competitors. Therefore, differentiation must come from operational excellence, with punctuality as the core value proposition.

Artificial Intelligence (AI), as described in the attached course material, is particularly suitable for this type of problem because it excels at managing complexity, uncertainty, large volumes of data, and real-time decision-making. By combining machine learning, computer vision, sensor data, and intelligent decision systems, the airline can transform punctuality from an operational goal into a competitive advantage.

This assignment analyzes the 17-point AI-based plan introduced by Emily, focusing on how AI technologies can be applied across airline operations.

ANSWERS 1

Problem Context

Operators are required to complete a short report after finishing each task. However, in real operational environments, human behavior is imperfect: an operator may complete a task correctly but forget to submit the report. Treating this as a failure would be counterproductive and could damage morale.

AI-Based Solution

According to the AI concepts presented in the course, this problem can be addressed using a combination of **computer vision**, **sensor fusion**, and **machine learning classification models**.

1. Multimodal Data Fusion

AI does not rely on a single data source. Instead, it combines:

- Camera feeds (computer vision)

- Sensor timestamps (IoT sensors on equipment and workstations)

- Historical operator performance data

Using data fusion, the AI system evaluates whether:

- The task was physically completed (detected via vision and sensors)

- The quality standards were met

- The time spent was within normal bounds

If all operational indicators confirm task completion, the absence of a report is classified as a **documentation anomaly**, not an operational failure.

2. Anomaly Detection Instead of Rule-Based Punishment

The course emphasizes that modern AI systems move away from rigid rule-based logic toward **probabilistic reasoning**. An anomaly detection model (e.g., unsupervised learning such as clustering or isolation forests) can detect patterns such as:

- Frequent missed reports by the same operator

- Rare, isolated reporting omissions

A single omission with normal task execution is treated as noise, not a problem.

3. Human-in-the-Loop AI

The system flags only *patterns*, not individuals, to supervisors. This aligns with the theoretical concept of **augmented intelligence**, where AI supports human decision-making instead of replacing it.

Strategic Impact

This approach improves punctuality without creating a culture of surveillance or punishment. It also increases trust in AI systems, which is critical for long-term adoption.

ANSWERS 2

Vision Tech AI relies on **deep learning-based computer vision**, particularly **Convolutional Neural Networks (CNNs)**, as described in the course material.

1. Pattern Recognition Beyond Characters

Unlike traditional Optical Character Recognition (OCR), Vision Tech AI does not read letters individually. Instead, it recognizes:

- Shapes

- Contextual patterns

- Relative positioning of characters

This allows the system to interpret labels even when:

- Ink is faded

- Labels are scratched

- Characters are partially hidden

2. Training on Degraded Data

The Course explains supervised learning using large datasets. Vision Tech AI is trained on:

- Clean labels

- Partially damaged labels

- Intentionally distorted samples

As a result, the model learns *probabilistic reconstruction*.

3. Can It Read Missing Characters?

Yes—but with limits.

Using **context-aware inference**, the AI can infer missing characters if:

- The label follows a known format (e.g., flight number, baggage code)

- Redundancy exists in the system (barcodes + alphanumeric data)

For example, if "BA_27" is detected and the airline format requires five characters, the AI can infer the missing digit with a confidence score.

If confidence is low, the system escalates to human verification, ensuring reliability.

ANSWERS 3

AI as a Cognitive Assistant

AI assistants are built using **Natural Language Processing (NLP)**, **intent recognition**, and **reinforcement learning**.

1. Core Functions

An AI assistant in customer service can:

- Answer FAQs instantly

- Manage rebooking during delays

- Provide personalized flight information

- Predict customer needs based on past behavior

2. Can AI Sell a Ticket?

Yes. Technically and commercially.

Using **decision trees combined with recommendation systems**, AI can:

- Identify customer intent

- Suggest optimal flights

- Apply pricing and availability rules

- Complete secure transactions

However, Customers must know they are interacting with an AI.

3. Strategic Value

This reduces human workload, speeds up service, and indirectly improves punctuality by reducing bottlenecks at check-in and boarding.

ANSWERS 4

Boarding delays are a major contributor to late departures. AI addresses this through **optimization algorithms** and **real-time monitoring**.

1. Predictive Boarding Models

AI analyzes:

- Passenger arrival patterns

- Hand luggage volume

- Special assistance needs

Using predictive analytics, the system dynamically adjusts boarding groups.

2. Computer Vision at Gates

Cameras detect:

- Passenger flow density

- Boarding pass scanning success rates

If congestion is detected, the system alerts staff or adjusts boarding speed.

3. Outcome

This transforms boarding from a static process into an adaptive system, directly supporting punctuality goals.

ANSWERS 5

A humanoid robot equipped with AI can:

- Guide passengers to gates

- Answer flight-related questions

- Reduce pressure on human staff

1. Contribution to Punctuality

By preventing passenger confusion and late arrivals at gates, the robot indirectly improves on-time departures.

2. Multi-Airline Use

Yes, users from other airlines could use the robot, but priority algorithms would favor the host airline. This creates both operational and reputational advantages.

3. Conversational Ability

Using advanced NLP models described in the PDF, the robot can hold contextual conversations, understand follow-up questions, and adapt responses.

Conclusion

The case demonstrates how Artificial Intelligence, when applied holistically, can transform airline punctuality into a sustainable competitive advantage. Emily's plan succeeds not because of one single technology, but because of the integration of AI across operational, customer-facing, and strategic layers. By applying theoretical AI concepts such as machine learning, computer vision, NLP, and human-in-the-loop systems, the airline achieves both operational excellence and customer trust.