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University of Texas at Dallas

Cargo Connect: Improving Airport Freight Flow

Group 1

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INTRODUCTION

Airports serve as critical hubs for global trade, yet inefficiencies in freight operations such as restricted access controls, fragmented data ecosystems, and infrastructure bottlenecks result in delays, missed deadlines, and increased costs. The Cargo Connect project addresses these challenges by proposing a solution that leverages real-time data integration, predictive scheduling, and adaptive routing algorithms. This feasibility study evaluates the viability of the project across technical, economic, operational, and legal dimensions; it also includes a feasibility matrix to determine whether it aligns with stakeholder needs and delivers measurable value.

Purpose

This feasibility study evaluates a comprehensive system redesign that will:

- Assess the technical and operational viability of the freight management platform.
- Validate the overall economic feasibility.
- Ensure compliance with aviation security standards and data protection regulations.
- Provide decision-makers with actionable insights for project implementation.

ECONOMIC FEASIBILITY ANALYSIS

The economic feasibility of this project is favorable, as it primarily requires student effort and time rather than financial investment. All necessary resources are accessible and manageable within our skill set, ensuring feasibility without external funding. Given the reasonable workload and achievable timeline, the project is viable and sustainable for successful completion.

TECHNICAL FEASIBILITY ANALYSIS

Intelligent Access and Resource Management

- **Dynamic Allocation of Loading/Unloading Bays**: This requires processing of real-time traffic data, history traffic patterns, and use of advanced predictive algorithms to ensure efficient allocation of bays, all while considering delays and cargo handling times.
- **Smart Parking Management**: This uses Internet-Of-Things (IoT) sensors for real-time monitoring and tracking of space availability. However, challenges involved include handling real-time assignments, ensuring scalability and flexibility in data flow management under high-traffic conditions.
- **Automated Routing to Optimal Exits**: With machine learning and GPS, we can automate routing. Achieving real-time accuracy in changing traffic conditions is vital.

Predictive Operations Platform

- **Aircraft Arrival Monitoring and Freight Release Prediction**: This is feasible via integration of flight tracking data and using machine learning techniques to predict release times using both historical and real-time data.
- **Priority-Based Cargo Loading**: This needs smart scheduling and dynamic interaction with handling of cargo to ensure highly efficient loading based on priority. However, ensuring this is done in real-time can be complex.
- **Emergency Handling and Congestion Management**: With machine learning and effective predictive algorithms, we can attain this goal, although we must ensure that the system is able to act quickly to reduce disruptions.
- **Dynamic Route Optimization**: This is feasible with GPS tracking, weather and real-time traffic data, and traffic management systems. Integration with DALI and navigation software will provide optimized routes and arrival times. However, there are challenges around ensuring accurate, fast and efficient updates under real-time and unsteady conditions.

Unified Data Ecosystem

- **Integration of Data Sources**: This is feasible with API and middleware integrations, including integrations with GPS tracking systems, together with advanced machine learning techniques, although standardizing data formats and managing disparate data streams from various systems (like airports, customs, and carriers) is challenging.
- **Real-Time Admin Dashboard**: This is feasible with Business Intelligence (BI) tools. However, this depends on continuous communication with DALI, which requires a dedicated communication channel and system, advanced decision support, actionable insights, and predictive alerts to ensure that the admin can effectively manage operations.

Overall Feasibility

The technologies involved for RFID, IoT, GPS, ML, etc., are available and proven, but combining them into one coordinated, real-time, seamless, and scalable system for airport logistics is a challenging problem. It involves specialized optimizations in data flow and system integration. While this is technically feasible, a strong infrastructure and skilled and organized team will be essential to bring it all together.

OPERATIONAL FEASIBILITY ANALYSIS

Operational feasibility evaluates whether the proposed system will solve business problems effectively and integrate smoothly into daily workflows.

System Integration:

- **Real-time Integration:** System will seamlessly integrate with DALI and existing airport system for real-time data sharing.
- **Data Flow Management:** System will handle scheduling tasks (Airplane Scheduling, Cargo Scheduling, Dock Assignments and Parking Data) efficiently.
- **GPS Integration:** Continuous tracking and updating of freight truck locations.
- **Route Optimization:** Dynamic route suggestion with the use of DALI application for both entry and exit to the airport seamlessly.

User Adoption and Workflow

- **Truck Operator Interface:** Application interface should display clear timings, dock assignment location, notifications, alerts, and parking information.
- **Minimal Disruption:** System designed to enhance the freight workflow without major operational changes at the Airport.

Stakeholder Benefits

- **For Airport Management:**
  - System will help to allocate resources through real time data.
  - System will improve dock and parking space utilization.
  - System will enhance traffic flow management at entry and exit points.
- **For Truck Operators:**
  - System will provide clear guidance on optimal routes and entry/exit points.
  - Real-time updates on dock assignments and parking.
  - System will help to reduce the waiting times and improved scheduling.
- **For Cargo Operations:**
  - System will improve the coordination between airplane and truck schedules.
  - System will predict loading/unloading operations more accurately.
  - System will enhance tracking of cargo movement.

SCHEDULE FEASIBILITY ANALYSIS

Schedule feasibility evaluates if a project can be finished in the allotted amount of time. It involves evaluating the project's schedule, goals, and possible obstacles to make sure it can be completed on schedule and with all its goals met.

- Estimated project duration: The duration of project is 3 months.
- Can all the milestones and completion date schedules be met?
    - For the freight transportation problem, milestones include:
        - Requirement gathering, Planning and design – Month 1
        - Development and integration – Month 2
        - Testing, Deployment, and training – Month 3
    - By limiting the requirements to a few, as well as implementing proper project management and team planning, the milestones can be met in 3 months.
- For this project, a 3-month deadline is mandatory, as this project is confined to only one semester. Hence, the requirements are limited.
- The learning curve duration would be a few days in the final month. The learning curve for users to adopt to new system can be minimized by:
    - Providing a training session.
    - Designing a user-friendly interface.

Tentative project plan

- Month 1
    - Design and Planning
    - Collect and analyze requirements.
    - Complete the design architecture, features, and scope.
    - Create prototypes.
- Month 2
    - Integration and Development
    - Create the essential functions, such as scheduling, real-time tracking, and notifications.
    - Connect to external systems (such as airport systems, traffic APIs, and GPS).
    - Perform preliminary testing on each module separately.

- Month 3:
    - Deployment, Training, and Testing
    - Conduct thorough testing, including security, performance, and functional testing.
    - Organize end-user training sessions.
    - Complete the system based on user input and fully implement it.

Will the project be useful by the time it is completed?

The proposed solution will improve efficiency, reduce delays, and optimize resource utilization. Hence it will be very helpful in addressing freight transportation challenges.

LEGAL FEASIBILITY ANALYSIS

In terms of copyright infringements, failing to respect patents could result in lawsuits or forced removal of critical features. This applies to trademarks as well. Proper patent research and trademark clearance must be planned out ahead of time to avoid any future trouble.

As far as privacy concerns go, privacy laws must be a major focus due to the involvement of customer data in the mix. Tracking the movement of freight trucks in real-time also poses potential issues with surveillance. This means transparency of data practices will be a critical component of the project.

Copyright Infringements (IP, Patents, Trademarks, etc.)

– A failure to respect patents could result in expensive lawsuits or the forced removal of key features. The same applies to trademarks. Ensuring proper patent research and trademark clearance should be part of the planning phase to avoid any disputes down the line.

Privacy Concerns (DALI-vehicles and Customers' Information)

- Since this project involves vehicles (and potentially customer data), privacy laws must be a major focus. Additionally, tracking movements and behavior in real-time raises potential concerns around surveillance, so transparency of data practices will be critical.

Violation of Pre-existing Contracts and Agreements

- Sometimes, software or data shared under a licensing agreement may not be used for other purposes, or certain territories may be off-limits. Violating these terms could result in legal action, termination of agreements, or financial penalties.

Concerns Around Operational Licenses for Drivers and Other Operators

- The project needs to verify that drivers and operators meet the regulatory requirements in each jurisdiction where the service operates. Non-compliance could result in fines, delays in project rollout, or even the inability to offer the service in certain areas.

Environmental Concerns (As We Are Dealing with Moving Vehicles)

- Assessing environmental impact could involve looking at emissions, fuel consumption, and how vehicles contribute to local air quality. Any project of this scale may require compliance with local environmental laws or regulations surrounding noise, emissions, or resource use.

FEASIBILITY ANALYSIS MATRIX

Aspect	Rating	Comment
Economic	4/4	It is economically feasible (especially because we are not relying on any hardware components).
Technical	3/4	Achievable with stakeholder partnerships and scalability of the project.
Operational	4/4	It makes the workflow more efficient with minimal disruption.
Schedule	3.5/4	Our team's aim is to complete all work as scheduled.
Legal	4/4	We are within legal boundaries in doing this project and have put our own ideas into it.