

The Virtual Dispatcher

Intelligent Flight & Fleet Management System

ABSTRACT	2
INTRODUCTION	2
STRATEGIC IMPORTANCE	2
UNIQUE FEATURES	2
INTELLIGENCE	2
CUSTOMIZATION	3
ACCOUNTABILITY	3
DECISION MAKING SPEED	3
EVOLUTION	3
BENEFITS	3
IMPROVED PROFIT	3
IMPROVED QUALITY OF SERVICE	3
IMPROVED RETURN ON INVESTMENT	3
IMPROVED TRANSPARENCY	3
IMPROVED PRODUCTIVITY	3
IMPROVED MANAGEMENT	4
SUBSCRIPTION	4
VIRTUAL DISPATCHER ARCHITECTURE	4
PART 1 VIRTUAL FLIGHT DISPATCHER	5
FUNCTIONAL SPECIFICATION	5
<i>Core Functions</i>	5
<i>Optional Functions</i>	5
<i>Real-time scheduling and dispatching of flights, aircraft and crew</i>	5
<i>Dynamic pricing of seats</i>	5
<i>Core System Customization</i>	6
<i>Optional Functions</i>	6
DESIGN SPECIFICATION	6
<i>Architecture</i>	6
PART 2 VIRTUAL ROAD TRANSPORT DISPATCHER	7
FUNCTIONAL SPECIFICATION	7
<i>Core Functions</i>	7
<i>Optional Functions</i>	7
<i>Real-Time Scheduling of Vehicles and Drivers</i>	7
<i>Dynamic pricing of transportation</i>	7
<i>Order Processing Function</i>	7
<i>Core System Customization</i>	7
<i>Optional Functions</i>	8
DESIGN SPECIFICATION	8
<i>Architecture</i>	8

Abstract

The Virtual Dispatcher is a unique complex adaptive system which autonomously allocates transportation resources to transportation demands. It schedules, in real time, flights, aircraft, crew, trucks, drivers, taxis, even flying cars.

The Virtual Dispatcher is vastly superior to current dispatching and scheduling approaches, which rely on human dispatchers and various mutually incompatible dispatching, scheduling and costing packages. The reduction in costs is typically between 20% and 25%.

Introduction

The Virtual Dispatcher is an intelligent flight & fleet management system designed in two versions, one for aerospace and the other for the land transport applications.

The aerospace version is equally effective when used by air taxi businesses operating a relatively small number of aircraft between local airports, registered landing sites or vertiports; by corporate jet fleets; or by smaller and even larger airlines.

The land transport version is designed for applications such as scheduling and dispatching of car, van and truck fleets.

Strategic Importance

Current focus on investing into *production* of spacecraft, electric aircraft, electric cars, electric trucks, electric drones and flying cars, is not matched by the investment into systems which will be required to *manage* all these sophisticated flying and road travelling transporters.

There is an urgent need to remedy this situation and channel funds into the development of autonomous intelligent fleet management systems such as the Virtual Dispatcher.

Without advanced fleet management systems new aircraft and vehicles will not be optimally organised, scheduled and utilised.

Unique Features

Intelligence

The Virtual Dispatcher increases productivity and reduces operational costs by autonomously (without human intervention) making the following resource allocation and dispatching decisions:

- In response to a demand (a request for a seat, a transportation enquiry), the system selects appropriate resources (aircraft, vehicles, crew), schedules them, calculates exact costs of meeting demand and negotiates the price of transportation with the customer
- Continuously monitors critical data sources and instantly detects any disruptive event (changes in demand, delays, failures of resources, changes in transportation conditions, such as weather or route closures)
- Within seconds identifies which part of the operation will be affected
- Rapidly reschedules affected parts of the operation to eliminate consequences of disruption, always maximizing the enterprise value
- Rapidly calculates costs of disruption and accordingly adjusts transportation pricing
- During intervals between disruptions, the system analyses previously agreed schedules and costs and, if necessary, makes corrections or improvements.

Customization

The Virtual Dispatcher can be customized to cover any specific policy, regulation, tradition, preferences or any other requirements unique to the client and to be compliant with all rules and regulations mandatory at the client location.

Accountability

The Virtual Dispatcher provides human dispatchers with interfaces for checking the system decisions and changing them, if necessary. The system provides feedback to human dispatchers on the effectiveness of their interventions.

Decision Making Speed

The Virtual Dispatcher schedules resources and calculates dynamic transportation price within minutes of a transportation request by a customer.

Evolution

The Virtual Dispatcher is designed to be easily extended as requirements change. It could be amended to accommodate a change in most requirements at any time without service interruption.

Benefits

Improved Profit

The Virtual Dispatcher can achieve the same sale as other dispatcher systems with smaller number of resources (aircraft, trucks, crew), which leads to cost reduction and profit improvement. The System generates and compares more options for every transportation request than can be done manually in the time available. It consistently finds cost-effective solutions for every specific situation. A typical cost reduction is between 20% and 25%.

Improved Quality of Service

The Virtual Dispatcher reduces delays and cancellations by rapidly rescheduling affected resources whenever a disruptive event occurs and by thoroughly checking agreed schedules and costs of transportation in intervals between disruptive events. Delays are avoided and deliveries improved.

Improved Return on Investment

Typically, the investment is repaid in 6 months. If purchased as a subscription service, the Virtual Dispatcher substantially reduces upfront investment and enables our clients to delay payments until they start deriving benefits from the service.

Improved Transparency

The Virtual Dispatcher calculates costs of every single transaction, which gives our customers precise costs of sourcing, producing, transporting, storing and delivering every individual item. This feature enables businesses to easily identify cost-critical links in business processes and provides them with detailed cost analysis (per seat, per flight, per delivery, per customer).

Improved Productivity

The Virtual Dispatcher operates 24 hours a day, 7 days a week, continuously reacting to disruptive events and updating schedules. In intervals between disruptions, the service autonomously analyses performance and searches for ways to improve it.

Improved Management

The Virtual Dispatcher takes over a very large management load by autonomously making all routine scheduling decisions and thus enabling managers to focus on strategic and tactical issues. It also enables managers to intervene and change decisions made by the system.

To the best of our knowledge no such a system is currently available anywhere in the world.

Subscription

The Virtual Dispatcher is normally offered as a service on subscription. The minimum term is 1 year.

Virtual Dispatcher Architecture

The key elements are

1. Knowledgebase, consisting of ontology and data
2. Digital World in which Digital Agents exchange messages and negotiate solutions
3. Interfaces between Digital World of the Digital Dispatcher and Real World in which business operate

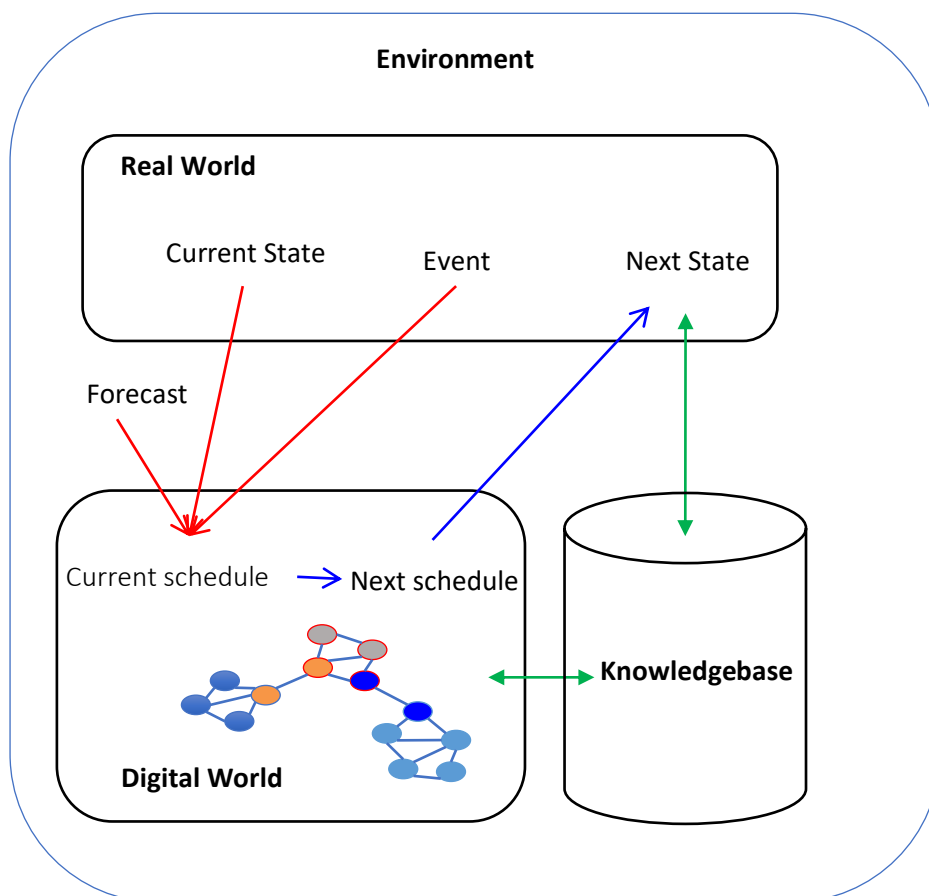


Fig. 1. Architecture

Part 1 Virtual Flight Dispatcher

Functional Specification

Core Functions

1. Real-time scheduling and dispatching of flights, aircraft and crew
2. Dynamic pricing of seats

Optional Functions

3. Booking of seats – three options: traditional, free text conversation or speech recognition
4. Aircraft maintenance
5. Scheduling of ground staff and supplies
6. Inventory control
7. Pilot licensing and/or training management
8. Customer relationship management
9. Intelligent accounting
10. Digital check-in
11. Direct communication between the system and aircraft (the internet of things)

All functions are fully synchronized and coordinated, and blend into a seamless flight management system.

Let's look at Core Functions in some detail.

Real-time scheduling and dispatching of flights, aircraft and crew

The system will perform the following tasks for every seat request:

- Create a flight
- Select aircraft for the newly created flight using criteria such as flight-readiness, cost of delivery to departure airport, and any other criteria specified by the client
- Select crew for the newly created flight using criteria such as license validity, rest time, cost of travel to aircraft, and any other criteria specified by the client
- If a disruptive event occurs (e.g., a change of demand for seats, breakdown of aircraft leading to unavailability or a delay, unavailability of pilots, unacceptable weather conditions), the system rapidly reschedules the affected flights, aircraft or crew

To create a flight, dispatching is now done mostly manually by dispatchers going to different systems to do calculations, get information, or input data, and to make sure the flight falls within specified parameters and rules (compliance).

The Virtual Dispatcher can create flights autonomously (without human intervention) by pulling data from all relevant sources on airports, e.g., from airport databases, on runway performance, on available aircraft and crew, e.g., from a crew tracking system, verifying that crew rest times and crew experience are compliant. It will also check that the selected airplane is within weight and balance parameters, based on passenger and fuel load. Passengers will be checked against the no-fly list. Checks will be also made if the most recent weather data comply with operational limits. Flights will be created in accordance with relevant flight planning rules and regulations.

Dynamic pricing of seats

The system will perform the following tasks for every flight

- Calculate cost of delivering the selected aircraft and crew to the departure airport
- Calculate cost of the flight, taking into account weather conditions and any other client specified criteria
- Send information on the seat price to the Booking Function within few minutes from the seat request

- If a disruptive event occurs (e.g., a change of demand for seats, breakdown of aircraft, unavailability of pilots), the system rapidly recalculates the seat price and sends new information to the Booking Function

Core System Customization

To be effective, the Virtual Dispatcher must be customized for each client to cover any specific policy, regulation, tradition, preferences or any other requirements unique to the client and to be compliant with all rules and regulations mandatory at the client location.

A Core System customized to client requirements can be delivered in 4 months. It comprises Core Functions:

1. Real-time scheduling and dispatching of flights, airplanes and crew
2. Dynamic pricing of seats

The Core System is normally scoped to schedule and dispatch up to 10 aircraft, 30 pilots and 300 flights per month between 60 airports. The Core System can be scaled up as required, at a price.

Optional Functions

Optional functions listed above can be added at any time.

Design Specification

The Virtual Dispatcher is designed as a *complex adaptive system* consisting of a large number of functionally diverse *digital agents* engaged in intensive interaction.

Knowledge on how to manage flights for a specific client is stored in a *knowledgebase*. Digital agents consult knowledgebase before undertaking any task.

Architecture

Key elements of the Virtual Dispatcher are, as shown in Fig.1, Knowledgebase, Digital World and Interfaces between Digital and Real World.

Knowledgebase consists of *ontology* and *data*.

Ontology includes *object classes*, *object classes relations*, *object classes properties* and *agent scripts*.

Object classes include: Customer, Seat, Flight, Airport, Runway, Airplane, Pilot.

Digital World is the world of digital agents. Agents create schedules and calculate costs of flights and price of seats in Digital World. An example how digital agents work is given below.

- A seat is requested on a flight between Airport 1 and Airport 2 for a particular date and time
- **Client12Agent** is assigned to the client who requested a seat
- Flight12 is created
- **Flight12Agent** is assigned to flight12
- **Flight12Agent** sends messages to **AircraftAgents** and **PilotAgents** asking which aircraft and which pilots are available for flight12
- Agents of available aircraft and pilots send their bids to **Flight12Agent** including cost of being delivered to the airport 1 in time for the flight12
- **Flight12Agent** selects aircraft and a pilot for the flight12
- **Flight12Agent** asks **CostService** to calculate flight12 costs and sends projected seat price to **Client12Agent**
- **Client12Agent** negotiates seat price with the prospective client; the agent is allowed to offer certain discount, if necessary

Digital World monitors data generated by Real World - demand forecasts, current state of the Real World, Disruptive events

Real World receives from Digital World – Schedules, Seat prices.

Part 2 Virtual Road Transport Dispatcher

Functional Specification

Core Functions

1. Real-time scheduling and dispatching of vehicles and drivers
2. Dynamic pricing of transportation
3. Order Processing

Optional Functions

1. Order Processing – free text conversation or speech recognition options
2. Scheduling of vehicle maintenance
3. Scheduling of auxiliary staff (loaders, guards) and supplies
4. Inventory control
5. Customer relationship management
6. Intelligent accounting
7. Direct communication between the system and vehicles (the internet of things)

All functions are fully synchronized and coordinated, and blend into a seamless road transport management system.

Let's look at Core Functions in some detail.

Real-Time Scheduling of Vehicles and Drivers

The system will perform the following tasks for every transportation order:

- Select vehicles for the arriving order using criteria such as availability of resources, cost of travel to the departure point and any other criteria specified by the client
- Select a route between departure and delivery points
- Schedules selected vehicles
- Chose drivers for the selected vehicle using criteria such as availability, rest time, cost of travel to the departure site and any other criteria specified by the client
- If a disruptive event occurs (e.g., a change of an order, breakdown of a vehicle leading to unavailability or a delay, unavailability of drivers, road closure, traffic jams), the system rapidly reschedules the affected vehicles and drivers

Dynamic pricing of transportation

The system will perform the following tasks for every order enquiry.

- Calculate cost of delivering the selected vehicle and driver to the departure point
- Calculate cost of fulfilling the order, taking into account any client specified criteria
- Send information on the transportation price to the Order Processing Function within few minutes from the order arrival
- If a disruptive event occurs (e.g., a change of an order, breakdown of a vehicle, delay, unavailability of a driver or of loaders), the system rapidly recalculates the order fulfilment price and sends new information to the Order Processing Function

Order Processing Function

The system will perform the following tasks for every order enquiry.

- Negotiate order fulfilment price with the customer, based on information received from dynamic pricing of transportation

Core System Customization

To be effective, the Virtual Dispatcher must be customized for each client to cover any specific policy, regulation, tradition, preferences or any other requirements unique to the client and to be compliant with all rules and regulations mandatory at the client location.

A Core System customized to client requirements can be delivered in 4 months. It comprises Core Functions:

1. Real-time scheduling and dispatching of flights, airplanes and crew
2. Dynamic pricing of seats
3. Order Processing

Optional Functions

Optional functions listed above can be added at any time.

Design Specification

The Virtual Dispatcher is designed as a *complex adaptive system* consisting of a large number of functionally diverse *digital agents* engaged in intensive interaction.

Knowledge on how to manage transportation for a specific client is stored in a *knowledgebase*. Digital agents consult knowledgebase before undertaking any task.

Architecture

Key elements of the Virtual Dispatcher are, as shown in Fig.1, Knowledgebase, Digital World and Interfaces between Digital and Real World.

Knowledgebase consists of *ontology* and *data*.

Ontology includes *object classes* – typically: Customer, Order, Cargo, Vehicle, Driver, Rout, Departure Point, Arrival Point.

Digital agents live and work in the Digital World. Agents create schedules and calculate costs of order fulfilment and price of transportation. An example how digital agents work is given below.

- An Order arrives for Transporting Cargo between Departure Point and Destination Point for a particular date and time
- **Order1Agent** is assigned to the new order (Order 1)
- **Order1Agent** sends messages to **VehicleAgents** and **DriverAgents** asking which vehicles and which drivers are available for fulfilling the order
- Agents of available vehicles and drivers send their bids to **Order1Agent** including cost of being delivered to the Departure Point in time
- **Order1Agent** selects vehicles and drivers for the Order 1
- **Order1Agent** asks **CostService** to calculate Order 1 fulfilment costs and sends transportation price to Order Processing Functions
- Order Processing Function negotiates transportation price with the prospective client; the Order Processing Function is allowed to offer certain discount, if necessary

Digital World monitors data generated by Real World

- demand forecasts
- current state of the Real World
- Disruptive events

Real World receives from Digital World

- Schedules
- Transportation prices