Dynamic optimisation of vehicle routes for heating oil distribution

Dyv❂il

Ant❂ptima

DyvOil consists of a main module - **TOUR PLANNING ASSISTANT** - for the daily tour planning, and of the following modules:

- **PREVIS**: forecasts the customers' consumption

- **SIMTOUR**: simulates the distribution process

- **TOUR ONLINE**: dynamically plans tours in real-time

DyvOil is the software application for the management and optimisation of heating oil distribution.

It is the result of the co-operation between AntOptima, a company specialised in innovative and high-performance optimisation algorithms, and Pina Petroli SA, a forward thinking Swiss company, leader in heating oil distribution.

The technology

DyvOil employs the innovative algorithms inspired by Ant Colonies, developed by *Istituto Dalle Molle di studi sull'intelligenza artificiale* within the framework of a project sponsored by the Swiss Commission for Technology and Innovation.

These algorithm learn from experience and can adapt to unforeseen situations. They can solve in just a few minutes problems that are otherwise intractable with traditional methods.

The advantages

DyvOil handles the logistics of the distribution of heating oils thanks to an integrated approach to the different sides of the problem, which allows to:

- optimise the use of the fleet of vehicles
- forecast the customers' consumption and reduce the costs of distribution
- improve the efficiency (less miles, less time, more deliveries)
- increase customer satisfaction, thanks to online management of urgent deliveries

DyvOil runs under Microsoft Windows and it can be integrated with the majority of commercial EDP systems.
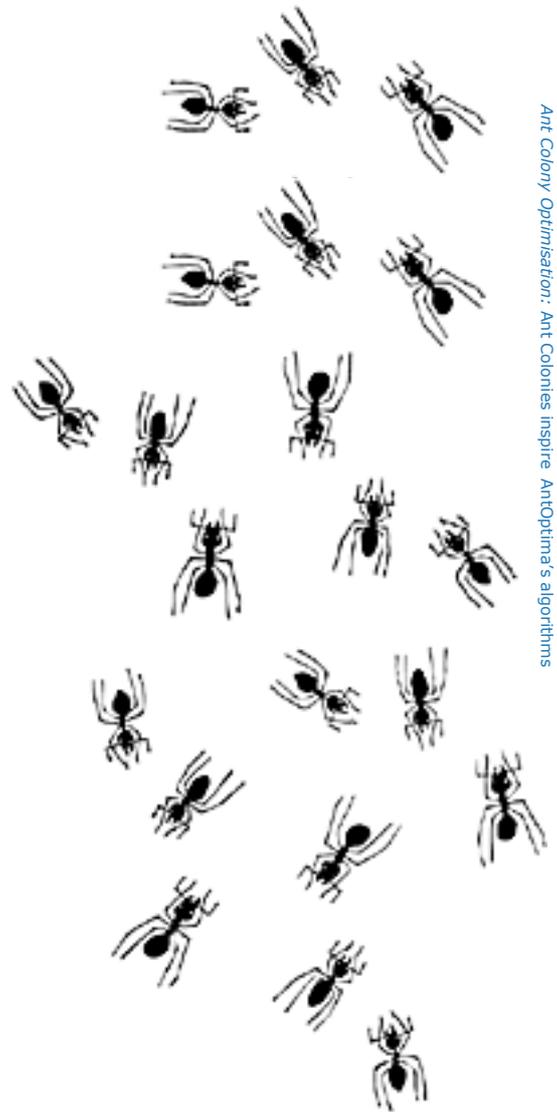
Ant Colony Optimisation: Ant Colonies inspire AntOptima's algorithms

DyvOil can be interfaced with GPS, GPRS/GSM devices to geo-localise the vehicles. It implements the German standard TDL DIN 26051-1 to exchange data with the onboard delivery measurement devices.

Tour Planning Assistant (main module)

Given a set of orders, access constraints, and delivery time windows, the main module computes the best delivery routes for your vehicles. This module manages non-homogeneous fleets, where vehicles may have different dimensions, equipment, and capacities. Solutions are optimised taking into account the loading time at the depot, the travel times, the set-up at the customers, and the delivery times.

The Tour Planning Assistant offers a user friendly and usable interface to visualise the state of orders (pending, in progress, delivered) and the state of the fleet.

Thanks to an integrated geographic information processing module, delivery routes are graphically displayed on a geographic map.
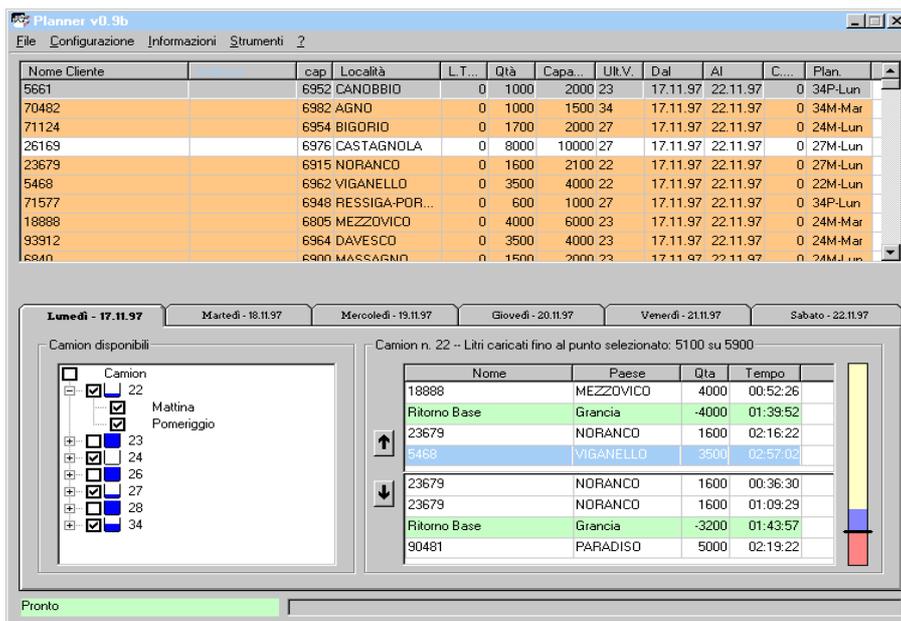
A sample screenshot of the user interface for the main module

The Tour Assistant Module is a fully fledged Decision Support System, which works side to side with the human tour planner in the preparation of delivery routes: while automatically computing them, it allows the user to evaluate and adapt the solutions to face unplanned and peculiar situations. The Tour Planner Assistant does not trade power for flexibility: it gives you both.

Previs

The consumption forecast module estimates the use of heating oil for every consumer. The forecast is based on the following factors:

- The daily termperature recorded since the last delivery
- the size of the customer's tank
- the reorder pattern, typical of each customer, extracted thanks to advanced *data mining* algorithms
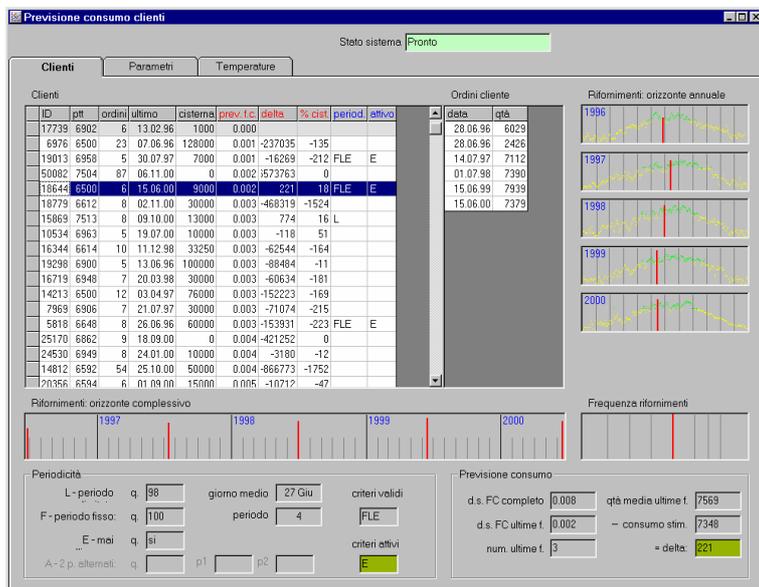
Thanks to the PREVIS user friendly interface you can keep a close eye on your customers

This module, able to forecast the reorder time for each customer, allows the sales representatives to contact the clients at the right time, anticipating their needs and strengthening customer fidelity. Moreover, anticipating customers' orders means a reduction in the number of urgent deliveries, with a positive impact on the quality of delivery routes, and of the service provided.

DyvOil can be interfaced with your company's database thanks to the ODBC standard, which supports most database systems, including Oracle, Microsoft SQL Server, Microsoft Access, and many others.

The human planner can use the tour simulation module to assess the feasibility and the quality of the automatically generated tours in front of new traffic and meteorological conditions, which are affected by uncertainty and are random in nature. In the simulation environment the user modifies the parameters to construct a set of delivery routes, which are both efficient and robust.

Thanks to SIMTOUR the planner can evaluate alternative strategies and analyse different plans and distribution scenarii. This module, used with the TOUR ONLINE module, plays a key role in the evaluation of management strategies for urgent deliveries.
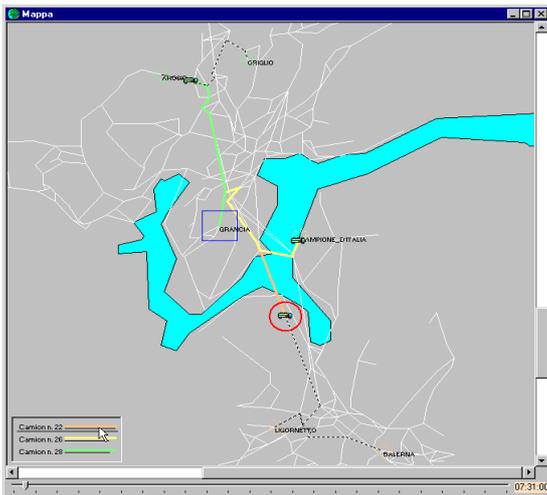
Tour Online

The online planning module is a tool of the utmost importance during the delivery process. Thanks to it, the planner can follow the execution of deliveries on the map, where the current vehicles' positions are represented. The fleet is connected to the base station via GSM/GPRS and is localised thanks to GPS devices.

On the basis of this information, the TOUR ONLINE module finds the best way to deliver incoming urgent orders, which keep coming during busy working days. These orders are very frequent in the case of heating oil deliveries, since during winter months customers cannot be left with an empty tank for more than a few hours. The flexibility and extreme speed of AntOptima's algorithms are the reason behind the performance of the TOUR ONLINE module, which returns quick answers and has the ability to adapt to the unforeseen.

TOUR ONLINE uses data transmitted from palm computers (see an example above) that are connected to the black-box of the tanker trucks, linked via GPS/GPRS to the base station

AntOptima's profile

AntOptima was founded in 2001 in Lugano, Switzerland, as a spin-off of Istituto Dalle Molle di studi sullÍntelligenza Artificiale, a leading research institute in AI. AntOptima acts as liaison between basic research and industrial production, providing companies with cutting-edge technology and ideas to cope with problems in optimisation, logistics, scheduling, and data mining. AntOptima solves complex industrial problems that require deep knowledge both of the production system and of the solution techniques. AntOptima's job involves identifying the correct level of abstraction of the problem and to apply the best available technological solution, integrating novel algorithms and hardware solutions within well-established information systems.

AntOptima's sofwtare is flexible and it evolves with your company's growth. We build intelligent systems that learn from past experience how to continuously improve the quality of the solutions.

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we speed up your business