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A REAL-TIME INFORMATION SYSTEM FOR URBAN BUS SERVICE MANAGEMENT

The aim of research is producing a floating vehicle car data (FVD) elaboration system to analyse speed and vehicle location; a system realizable by telematic development. Based on an intensive study of information collection, database structure, data process and information dissemination, this paper develops real time traveler information tool.

SYSTEM INFORMACYJNY CZASU RZECZYWISTEGO DLA ZARZĄDZANIA KOMUNIKACJĄ AUTOBUSOWĄ

Celem badań jest opracowanie systemu służącego do analizy prędkości oraz możliwości zlokalizowania pojazdów; systemu, który jest możliwy do zrealizowania dzięki rozwojowi telematyki. Na podstawie intensywnych studiów na temat przetwarzania danych oraz struktury bazy danych referat rozwija temat narzędzia związanego z rzeczywistym czasem przekazywania informacji.

1. INTRODUCTION

The different public utility market conditions of the public transport services utility and the modified rules and laws (liberalization, privatisation), impose adopting appropriate pattern to a business services administration . Competition between different sector's establishments, (costs reduction, wastes elimination, profits increase) have caused adoption of monitoring system, telematic and automation service and network systems. Telematic public utility services enable to improve the quality and to increase people quality life. Automation and telematic control represents a transparent opportunity to inhabitants information and communication, because of make possible a better information organization. Our work is an elaboration floating vehicle car data (FVD) application, to analyse speed and vehicle location; a system realizable by telematic development.

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2. TELEMATIC CONTROL

In view of an increasingly overloaded traffic infrastructure, the existing demand for transport should be handled with the greatest possible efficiency and environmental compatibility. One very promising approach is to use car more efficiently for commuter traffic, particularly during peck period. Despite a well-structured local public transport network, two-thirds of all commuters in Palermo's urban area currently use an automobile to travel to work.

For economic reasons it is seldom possible to offer attractive bus to service residential areas and work-places, which lie outside the main transport arteries.

Using FVD analysis makes possible improving transport service planning, and are qualified to analyse collective transport system. Data are about vehicle position and are collected by GPS.

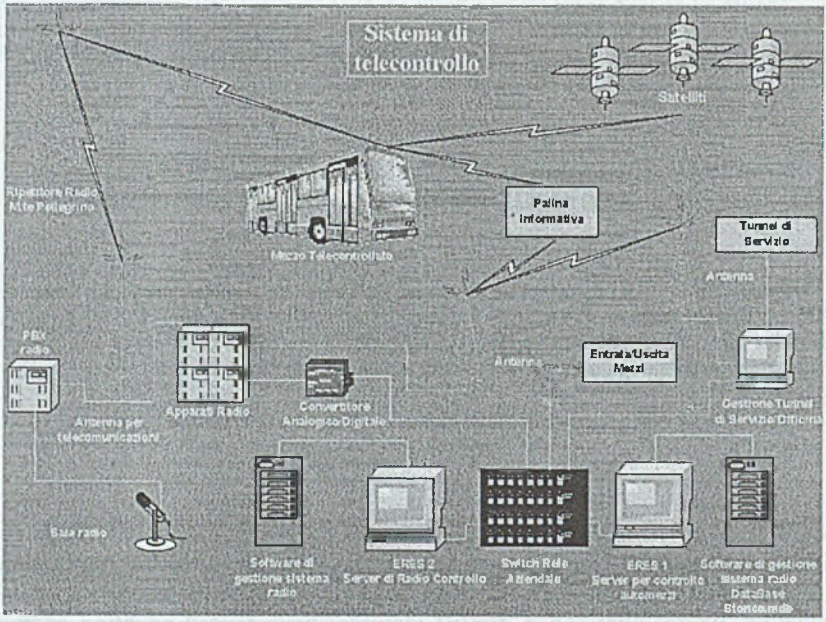

Fig.1. Data flow chart

The GPS-based system and digital data communication will provide vehicle status information. This capability will enable to provide itineraries based on actual vehicle speed. Vehicle bearing and real time information technology are for passengers the heart for a system realized to improve bus list in Palermo.

"NAVSTAR GPS", (NAVigation Satellite Timing and Ranging Global Position System) position system is based on receiving radio signal from an artificial satellite constellation. Devices for collecting and analysing space-temporal data of trips using GPS are (1) GPS antenna and receiver, (2) data collector and (3) GIS software. Two kinds of methods are possible using real-made goods.

System 1: carrying the hardware combined GPS antenna, receiver and data collector, and collecting data in it.

System 2: carrying GPS antenna and receiver connected portable computer, and collecting data in the computer.

In both of two systems, after collecting data we transfer data to main computer and analyse on GIS software. System 1 has many problems as battery, operation, capacity of memory, and in terms of portability since the device must be kept so that it can receive signals from a clear sky, therefore it is not suited to collecting multiple days trip data. System 2 is exclusive for collecting vehicle trip data but we tried to develop the system that can collect trip data of multiple days by simple operation. Therefore it continually collects GPS data of consecutive days for a week, month or year, within capacity of hard disk of a portable computer.

Every vehicle was equipped with a GPS system, controlled at least from 4 satellite (but often they are 6 or 8) and it gives output data organized in report to transfer them or to the main operative office by radio link or to other peripheral device by RS232.

System consist of 80 bus –mostly belonging to central lines- equipped with boarding computer and bus shelter in main city street with display for real time passenger information.

Bus, with GPS and interface with different control sensor, are "interviewed" every 40 seconds to detect on control centre vehicle position. updating the bus's position on a digital map.

Monitor for passenger information is a one line LED display with the number of the line and the time scheduled (in minutes) of next bus approccing; moreover this display receive data from control centre.

Position data from GPS are referred to a coordinate system WGS84 different from the Italian coordinate system. So we have realized a roto-traslation system of position data by function calibrated on 6 city point coordinate, using a differential GPS (4 cm precision)

Characters, from radio link like TCP/IP racket, are transferred to a server and memorized for a next elaboration.

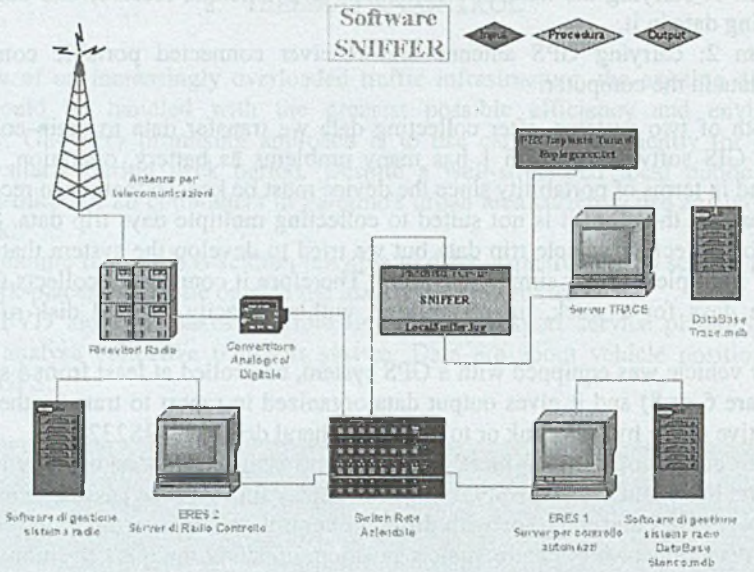

Fig.2. The system architecture

The whole system includes four subsystems: static database, dynamic database, data process system and interface.

The static database stores such network information as geographic information, bus lines and bus stop, while dynamic database contains real-time transit data (vehicle location).

For data analysis a software of control has been developed in Visual Basic 6, TRACE, in degree to decode alphanumeric lace created by the system GPS of edge. Every record is divided in standard fields and memorized inside a chart of database related to the single vehicle. During the elaboration, data that have lines, fields or characters not correspondents to the standard layout or that they have sting some cartographic limits of the area covered by the service out, they are discarded and introduced in an independent chart. A system of control guarantees that are not present redundant data.

The whole the data as picked they have reported to the served line and the single bus, identified through a number of register and to which have associated some technical characteristics (brand, type of feeding, length). The system includes map display of the service area and the transit network based on geographic information system (GIS). We use Arcview GIS software for displaying and analysing gives GPS.

Data collected constitutes a historical file of the net under different conditions of circulation. Beginning from the analyses developed on such file it is been able studied the course of the speed along an arc of net, in correspondence of different geometric configurations and regulation. You can build the curves of outflow this way able to furnish the middle speed of circulation of the single run in order to some parameters of reference and therefore of general application. It is possible so to have a model of service planning that keeps track of the conditions of outflow of the interested roads and able to furnish values of times of wait more likely to the use.

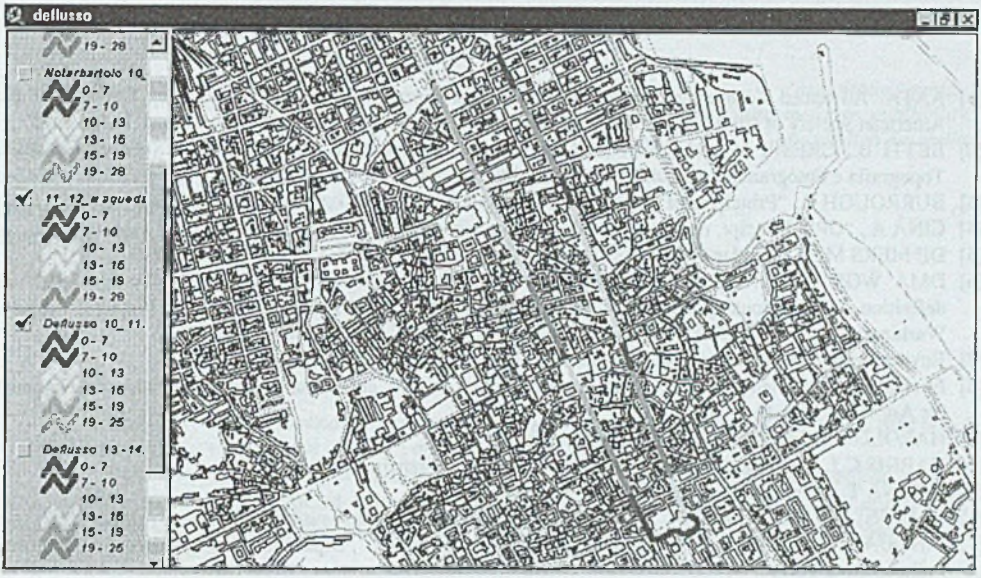

Fig.3. Speeds of the buses long central arteries of the city during the time-peek (km/h)

3. PERSPECTIVES OF DEVELOPMENT

In this study, we developed the travel data collecting and analysing systems using GPS and GIS.

A first step interests the palings of the stops that can work independently from control centre, receiving the data from the each bus that goes approaching and furnishing the time of arrival directly. The data, as TCP/IP packets, can also have consulted from the consumers from postings internet.

Thanks to use of GPSs, bus can record his position automatically inside a virtual zone around the semaphores in the intersections and to command his own priority.

The telematic control is an irreplaceable tool either for the automation and the management of a service of transport public, either for the harvest and the elaboration of the data and the information withdrawn by the " field " (environmental monitor of the territory). The telematic control represent, therefore, a managerial solution for the firms shopkeepers to improve the relationships with the use and to increase the satisfaction of the users and a tool for the public administrations (town, provincial and regional) and for the organisms of control (authority and guarantors), for environment monitoring and for the promotion of a sustainable mobility.

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