Chapter 1　What are Intelligent Transport Systems

第一章　什么是智能交通系统

1.1　Definition of ITS　ITS 的定义

ITS（Intelligent Transport Systems）is a generic term for the integrated application of communications, control and information processing technologies to the transportation system. The resultant benefits save lives, time, money, energy and the environment. The term“ITS”is flexible and capable of being interpreted in a broad or narrow way.“Transport telematics”is a term used in Europe for the group of technologies that support ITS.

ITS（智能交通系统）是对通信、控制和信息处理技术在运输系统中集成应用的通称。这种集成应用产生的综合效益主要体现在挽救生命，节省时间和金钱，降低能耗以及改善环境等方面。ITS 是灵活的，可以用广义和狭义的方式进行解释，在欧洲支撑 ITS 的技术群被定义为“运输的远程信息处理”。

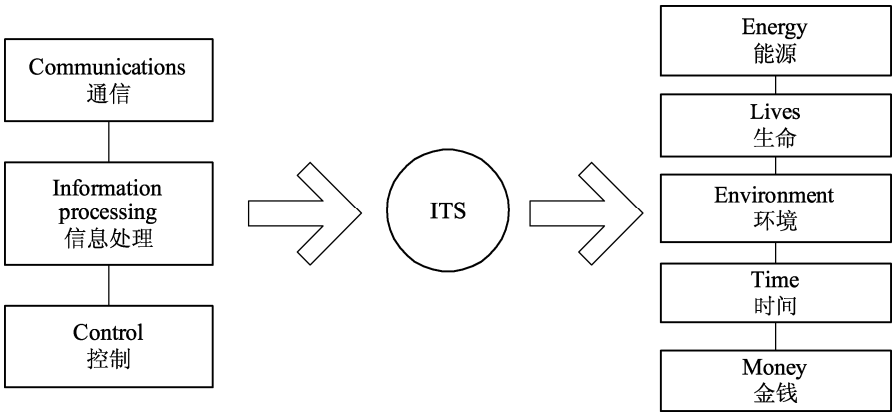

Figure 1.1　Comprehensive benefit diagram

图 1.1　综合效益框图

ITS covers all modes of transport and considers all elements of the transportation system: the vehicle, the infrastructure, and the driver or user, interacting together dynamically. The overall function of ITS is to improve decision making, often in real time, by transport network controllers and other users, thereby improving the operation of the entire transport system. The definition encompasses a broad array of techniques and approaches that may be achieved through stand-alone technological applications or as enhancements to other transportation strategies.

ITS 覆盖了所有的运输方式，并考虑运输系统中动态、相互作用的所有要素——汽车、基础设施、驾驶员或用户。ITS 的总体功能是通过改进（通常是实时地）交通网络的管理者和其

他用户的决策，改善整个运输系统的运行。ITS 的这一定义包含一个技术和方法组成的宽阔阵列，这些可以通过独立的技术应用获得，也可以作为其他运输策略的增强因素来达到预期目的。

1.2 Background of ITS ITS 的背景

1.2.1 Origins 起源

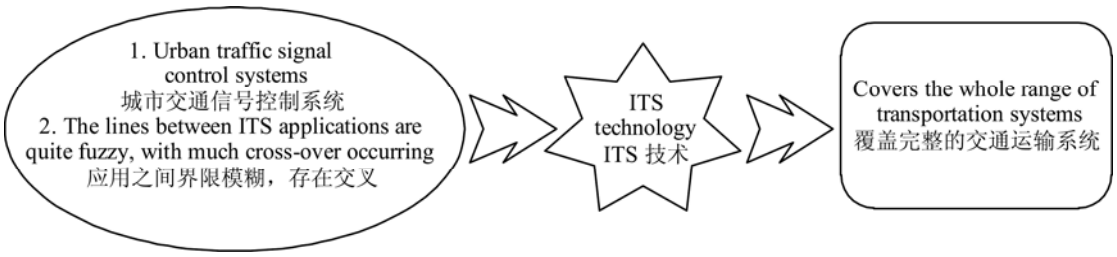

Figure 1.2 Origins of ITS
图 1.2 ITS 的起源

1.2.2 Motivation for ITS ITS 的目的

1. Helping to relieve congestion **帮助缓解拥堵**

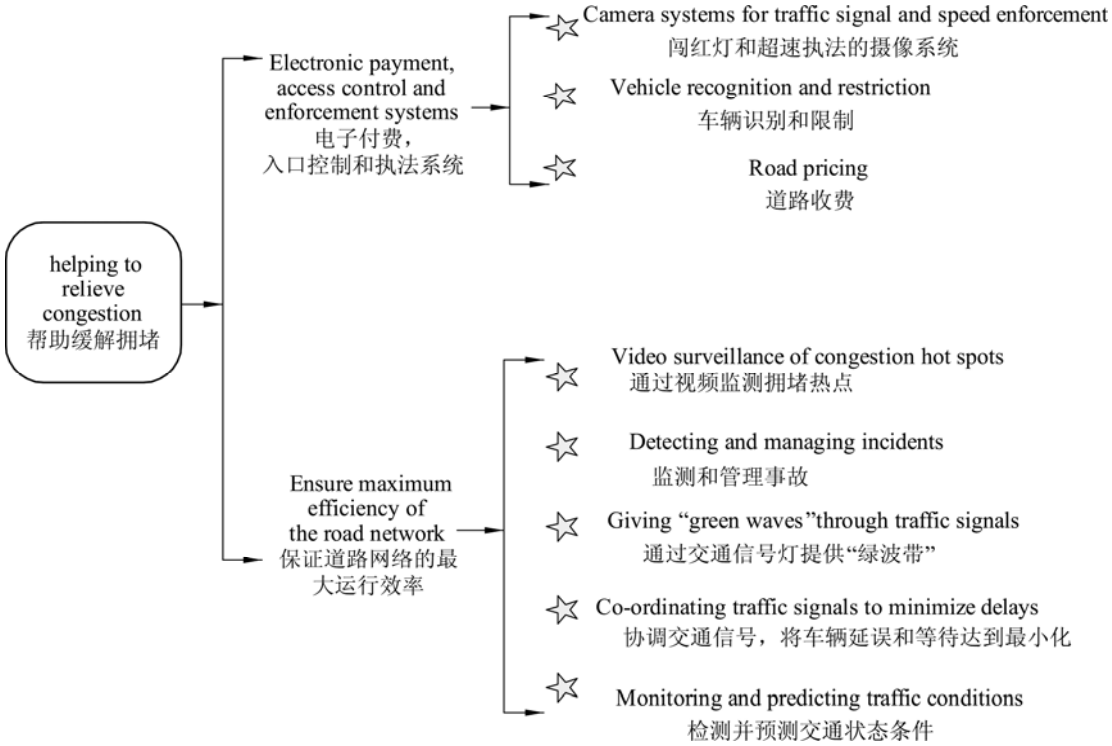

Figure 1.3 Framework of ITS helping to relieve congestion

图 1.3　ITS 帮助缓解拥堵的框架图

2. Safety and environmental benefits　安全和环境效益

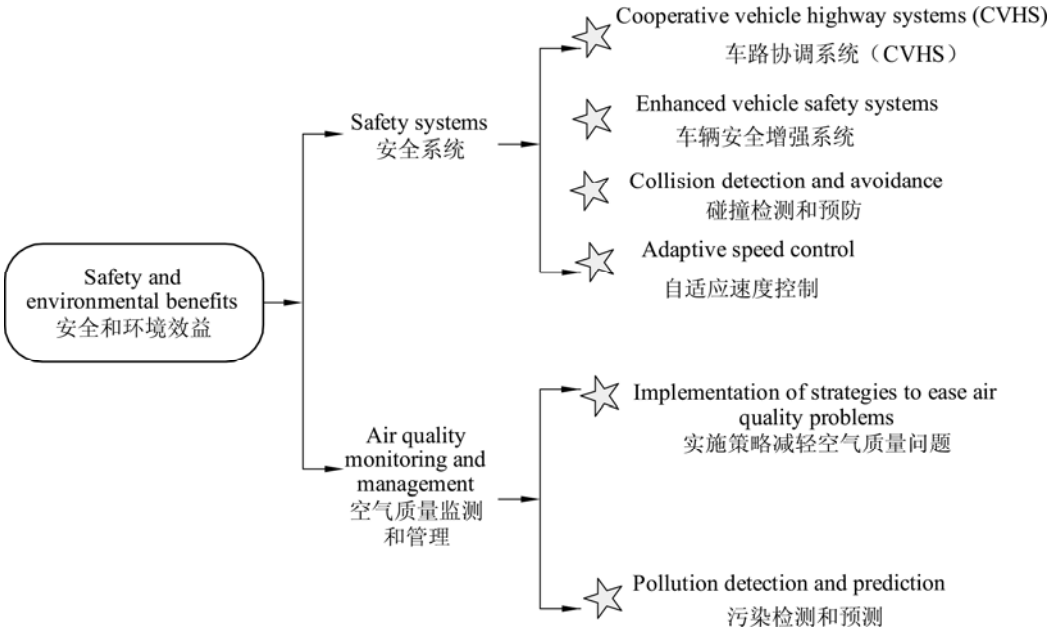

Figure 1.4　Framework of safety and environmental benefits

图 1.4　安全和环境效益框架图

3. Making public transport more attractive　让公共交通更具吸引力

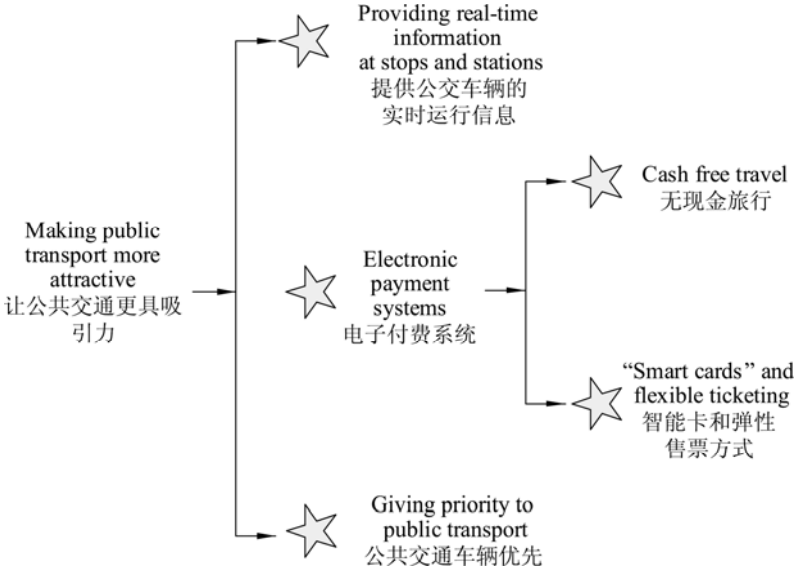

Figure 1.5　Application of ITS in public transport

图 1.5　ITS 在公共交通中的应用

1.2.3 ITS Deployment ITS 的部署

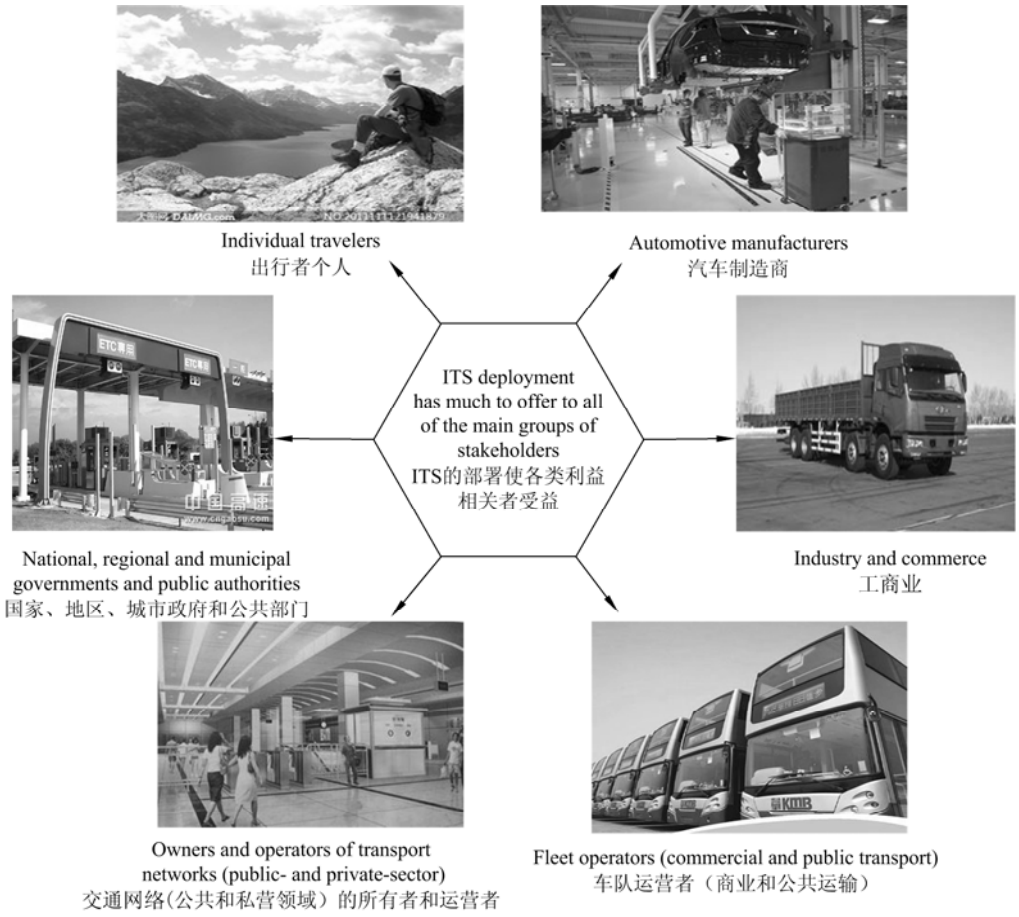

Figure 1.6 Stakeholders benefit of ITS

图 1.6 ITS 的相关者受益

At national level, governments can pave the way with enabling legislation (e.g. regulations for road user charging) and create frameworks for private-sector involvement(e.g. via public-private partnerships). At regional and municipal levels, they can implement demand management and integrated information (intermodal and multimodal) and payment systems, to encourage intermodal travel.

在国家层面，政府可以通过立法（如对道路使用者收费的法规）推进 ITS 部署，也可以为私营企业搭建平台（如通过公私合作）。在地区和城市层面，政府可以通过需求管理、信息集成（交互模式和多模式）和付费系统，鼓励多模式出行。

Operators of road, rail, tram and waterway networks and the associated transport interchanges (from road to rail and transit, and the airports, ports and ferry terminals) can manage their operations with better information and can provide users with safer or more reliable travel

conditions.

公路、铁路、有轨电车、水路网络以及相关交通交汇处（从公路到铁路和公共交通系统、机场、码头、渡轮及换乘点）运营者可以利用更充分的信息来管理自己的业务，并能为用户提供更安全或更可靠的出行条件。

From the market perspective, public authorities are major customers for applications such as traffic management and control, and road user charging. They also collect significant quantities of traffic data, which can be made directly available to road users, or to private-sector service providers for incorporating into commercial value-added services for the travelling public. Beyond these, the market will naturally tend to focus on developing products and services for key groups such as road and public transport operators; automotive manufacturers (as purchasers of original equipment manufacturer (OEM) equipment); fleet operators and the motoring public (as sources of demand for OEM equipment and purchasers of retrofits).

从市场的观点来看，公共部门是应用的主要客户，这些应用包括交通管理和控制以及向公路使用者收费。公共部门也收集大量的交通信息，这些信息可以直接提供给道路使用者，或提供给私营的服务供应商，从而将此信息合并到为公共出行提供的商业增值服务中。此外，市场也会自然地趋向于为重要群体开发产品和提供服务，诸如道路和公路交通运营者、汽车制造商（原始设备制造商（OEM）设备购买者）、运输公司运营者和驾车族（OEM 设备需求人及改装部件购买者）。

Automotive manufacturers can achieve significant product differentiation and customer loyalty by developing appropriate in-vehicle telematics products. Vehicle fleet owners can run more cost-effective services and save on energy costs. Businesses can move goods and services more efficiently.

汽车制造商通过发展适合的车载资讯通产品能够实现更明显的产品差异化和提高用户忠诚度。运输公司所有者能够提供更经济、节能的运营服务。企业能够更加便捷地运输货物并提供更有效的服务。

Individuals can plan journeys better, enjoy safer travel, avoid delays, and make informed choices between modes. All transport providers and users can enjoy greater security.

个人旅行者可以更好地计划行程，享受更安全的旅行，避免延误和方便地在不同交通模式中进行选择。所有交通运输服务的提供者和用户都能够享受到更多的安全保障。

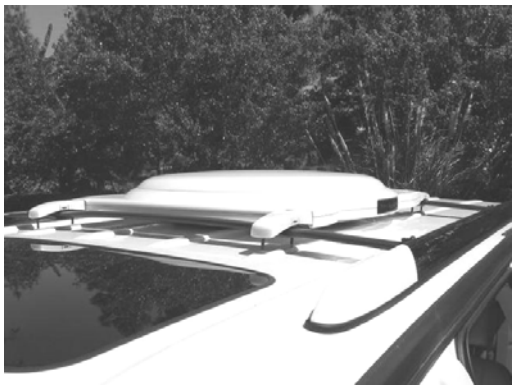

Figure 1.7　On-board satellite TV

图 1.7　车载卫星电视

Ultimately, many ITS benefits are likely to be invisible to the end user: ITS will simply improve safety, security, efficiency and comfort of the transport system and the environment without the general public being aware that ITS is at work. Therefore there is an important role for public awareness programs to show transport users how they can enjoy increased safety and security, better information, greater convenience and reduced journey time; and how populations as a whole can enjoy the healthier environments produced by sustainable mobility.

最后，ITS 的许多好处对最终用户而言似乎是不可见的——ITS 改善了交通运输系统的安全、保障、效率、舒适性和环境，公众却并没有意识到这是 ITS 作用的结果。因此，对公众的宣传尤为重要，它使交通用户了解如何才得以享受不断提高的安全和保障、更好的信息服务、更便捷的出行和出行时间的节省以及全体人民如何得以享受由可持续的机动性所创造的更健康的环境。

1.3　ITS Application Areas and Users　ITS 的应用领域和用户

1.3.1　Improving Safety and Security　改善安全和可靠性

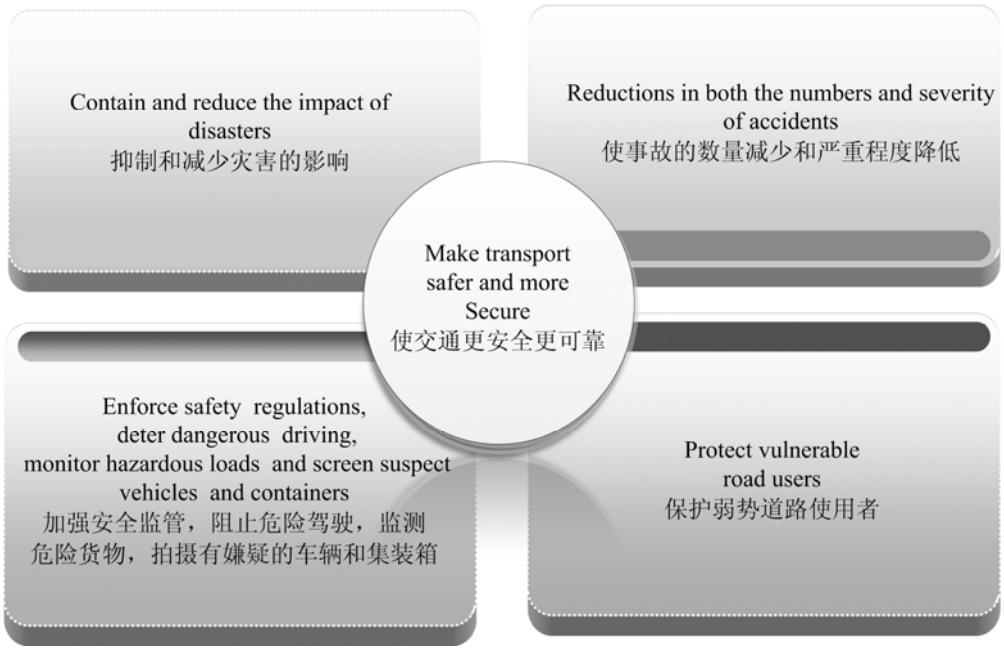

Figure 1.8　Improving safety and security

图 1.8　改善安全和可靠性

ITS services can make transport safer and more secure. They can maximize its capability to contain and reduce the impact of disasters, natural and man-made.

ITS 服务能够使交通更安全更可靠，它们能最大限度地抑制和减少自然和人为灾害的影响。

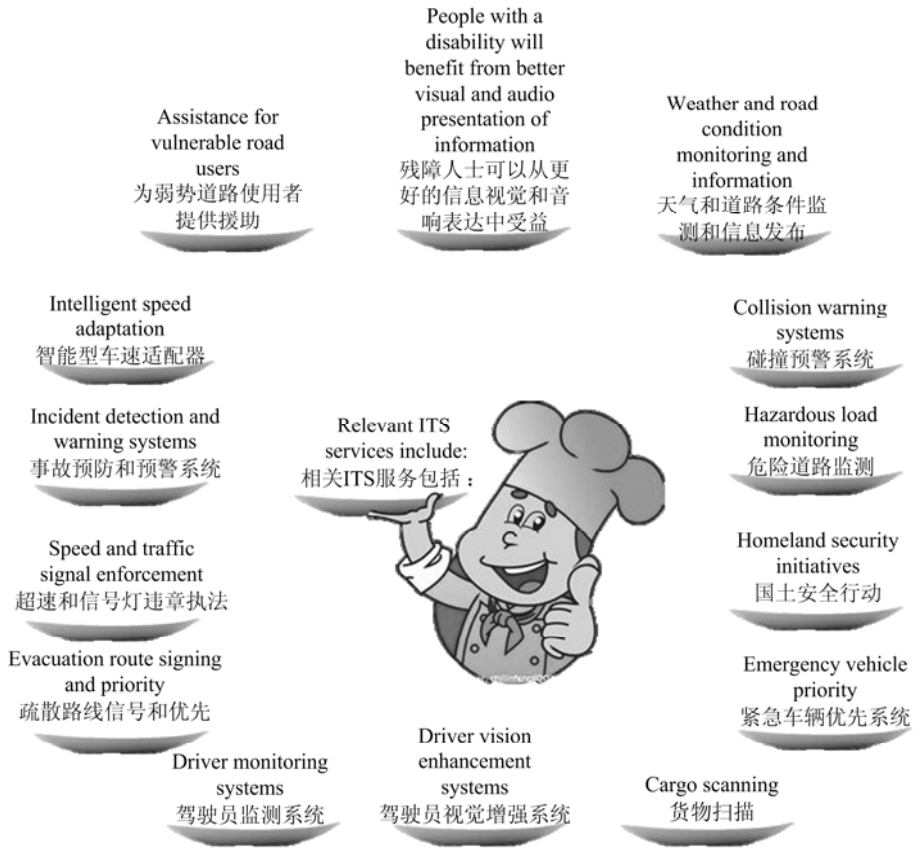

Figure 1.9　Relevant ITS services

图 1.9　相关 ITS 服务

1.3.2　Helping to Relieve Congestion　帮助缓解拥堵

Congestion is a major problem for all transport networks, and increasing the efficiency of existing transport systems is a major goal of ITS programs around the world. Congestion can be reduced by instrumenting networks to improve their real-time operation; introducing control systems; managing demand; and encouraging off-peak travel or the use of alternative modes.

对所有交通网络来说，拥堵都是一个主要问题，提高现有交通系统的有效性是世界范围内 ITS 计划的主要目标。通过网络手段改善路况的实时管理、引进控制系统、管理需求、鼓励非高峰期旅行或出行方式的改变可以减少拥堵。

1.3.3　Environmental Monitoring and Protection　环境监测和防护

Public concerns about the environmental impact of our transport systems have intensified in

recent years. Worldwide, the use of motor vehicles still shows no sign of decreasing and road traffic continues to rise. As a result, the environmental impacts from emissions and noise have become increasingly serious. Clearly urgent actions are needed from the transport sector toward environmental improvement, especially a reduction in carbon dioxide (CO_2) and nitrogen oxides (NO_x) emissions and in the management of urban and inter-urban traffic.

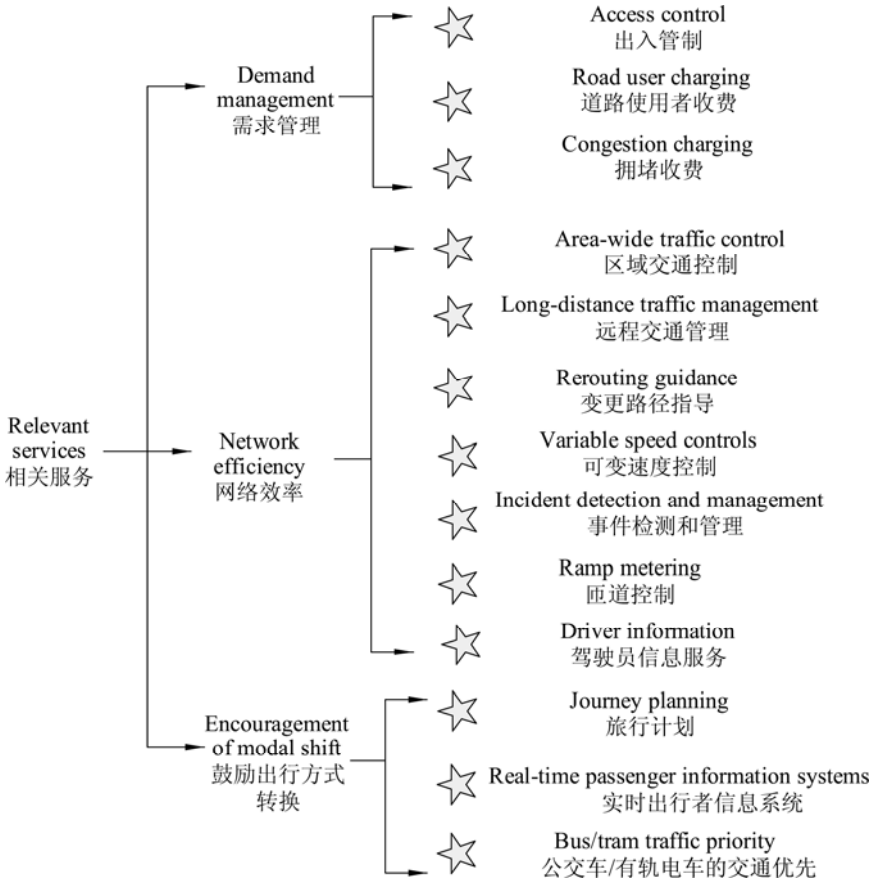

Figure 1.10　Relevant services

图 1.10　相关服务

近年来，公众越发关注交通系统对环境的影响，世界范围内仍然未见机动车辆使用下降的迹象而且道路交通量持续增长，由此产生的排放物和噪声对环境的影响日益严峻。为了改善环境，政府部门迫切需要采取行动，特别是减少二氧化碳（CO_2）和氮氧化物（NO_x）的排放以及城市和城间交通的管理。

Making transport systems run more efficiently can also bring corresponding benefits for the environment. ITS have much to offer here. For example, reducing traffic congestion or encouraging more people to travel by public transport directly reduces vehicle emissions and consequently air pollution. Environmental monitoring and evaluation of various environmental parameters is becoming especially important, in order to quantify the effects of policies and programs.

在使交通系统运行更有效，为环境带来相应的益处方面，ITS 能够做得更多。例如：缓解

交通拥堵或鼓励更多人使用公共交通出行能够直接减少机动车尾气的排放，减少空气污染。为了量化政策和方案的效果，环境监测和评价的各种参数尤为重要。

Figure 1.11　Vehicle emission exhaust

图 1.11　汽车尾气排放

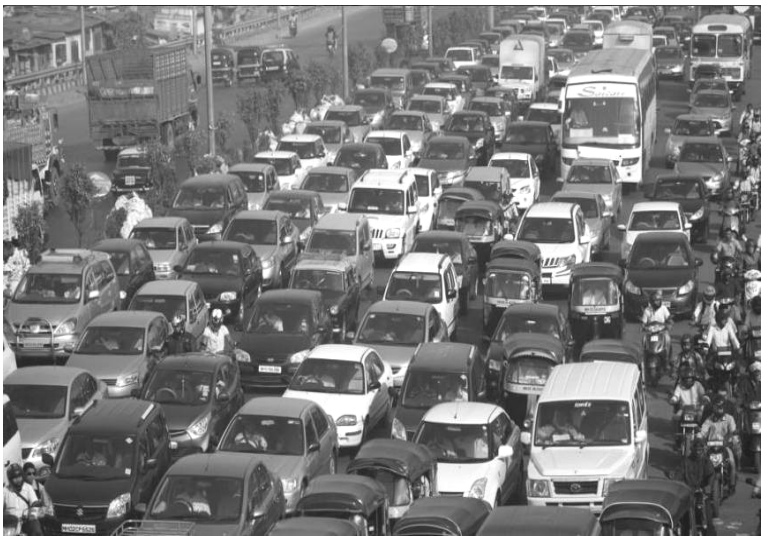

Figure 1.12　Traffic congestion brings trouble to the residents

图 1.12　交通拥堵给居民带来困扰

1.3.4　Productivity and Operational Efficiency　生产率和运营效率

ITS can make transport operations more efficient. Fleet management systems can reduce administrative and operational costs and deliver substantial improvements in productivity. Wider benefits include more rational use of the highway infrastructure, reduced congestion and pollution, and less risk of accidents due to monitoring vehicle and driver condition.

ITS 能够使运输运营更有效率。车队管理系统可以减少管理和运营成本，并且使生产率大

为提高。更广泛的好处，包括更合理地使用高速公路基础设施，减少拥堵和污染，通过监测车辆和驾驶员状况而减少事故风险。

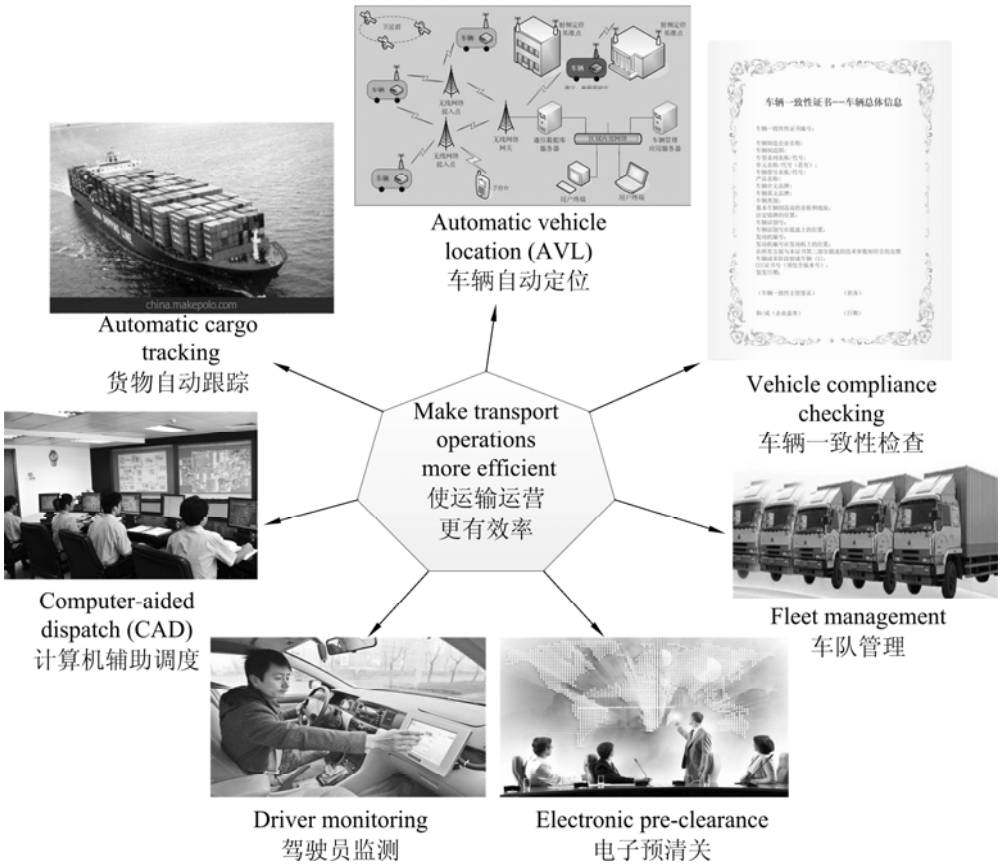

Figure 1.13　Related service of ITS

图 1.13　相关 ITS 服务

1.3.5 Comfort Factors　舒适因素

Users of any transportation system need to feel comfortable, confident and secure. Route confirmation, journey time estimates and clear advice on approaching interchanges and connections all play their part. Speed controls, ramp metering, advance incident and congestion warnings, and alternative route guidance can make road journeys easier and less stressful. Facilities such as multimedia systems that provide both entertainment and navigation can do this too. Public transport users also expect high standards of comfort, convenience and service. ITS can provide the real-time passenger information, automated scheduling and priority systems needed to improve public transport.

任何交通系统使用者都需要感到舒适、可靠和安全。路线确认、旅行时间预测以及有关换乘和连接的清晰建议都非常重要。速度控制、匝道控制、事故和拥堵预警以及可选路经指

导均能够使道路旅行更容易，并能减少旅行者的压力。多媒体系统等设施可以提供娱乐和导航功能。公共交通工具使用者也期望高标准的舒适、便利和服务。ITS 可以提供实时乘客信息、自动化的时刻表安排和改进公共交通系统所需的优先系统。

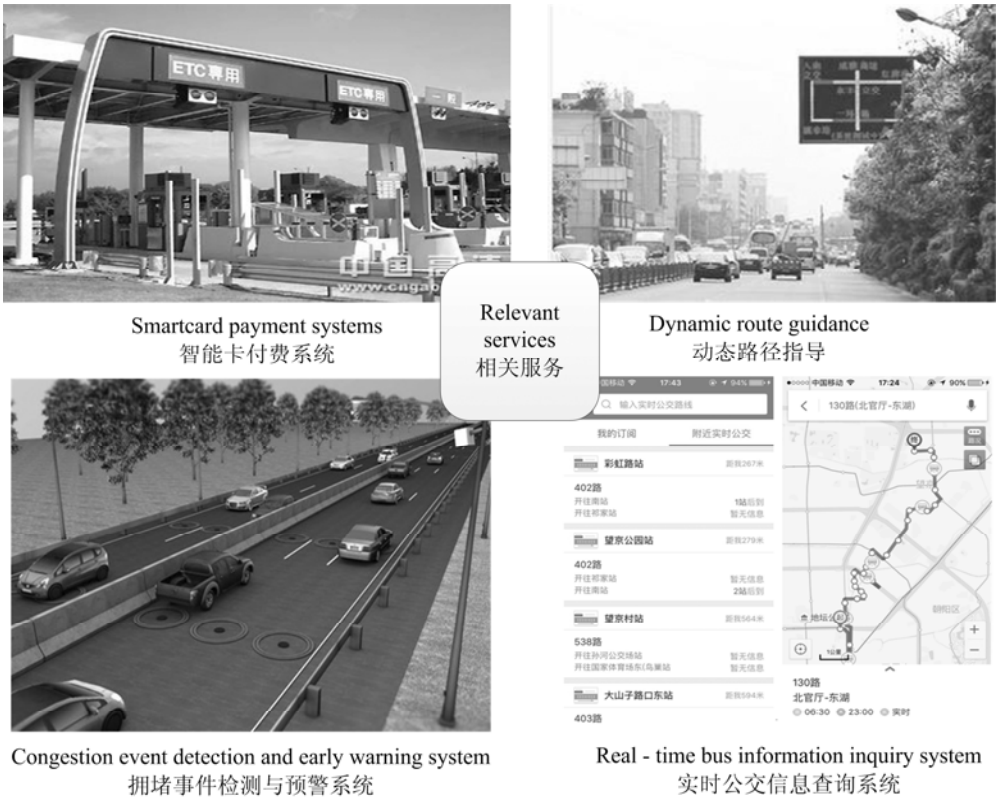

Figure 1.14　Relevant services

图 1.14　相关服务

例

美洲虎高级音响系统　“Jaguar Alpine Premium Sound System”

In 2003, Jaguar introduced an optional multimedia system allowing drivers and passengers to enjoy individual access to satellite Navigation or information/ entertainment via radio, CD/DVD players and TV. Those in front seats have touch-screen monitors that double as control panels for multimedia and in-vehicle functions such as climate control. Those in rear seats have video screens mounted in the back of front-seat headrests, with control panel set in armrests. Fibre-optic cables carry data around the vehicle.

2003年，美洲虎公司引入了可选配的多媒体系统，该系统能给驾驶员和乘客提供个人卫星导航服务和通过无线电台、CD/DVD播放机和电视机提供信息或者娱乐。前座安装的系统有触摸屏监视器，作为多媒体和车内功能的控制台，如温度控制。后座安装的设备有在前座的头枕后边装有视频屏幕，在扶手装有控制面板，在整个车辆上通过光纤来传输数据。

1.4　Basic Concepts　基本概念

ITS offers immense scope for integration, and some argue that it is only through integration of ITS components that ITS will achieve its full impact. Key ingredients are thorough planning, good communications and effective coordination of partners and stakeholder interests.

智能交通系统（ITS）为集成提供了极大的空间，有些人认为只要通过对 ITS 组件的集成，ITS 就能发挥其完整的效果。但是关键要素是需要完整的计划、良好的交流和对参与者和利益主体的利益的有效协调。

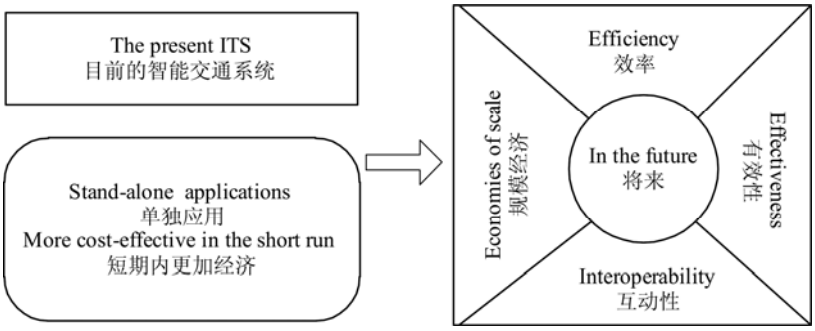

Figure 1.15　Change of ITS

图 1.15　ITS 的变化

1.4.1　Technologies　技术

（1）Communications　通信

① Microwave, short-range radio and infrared-based dedicated short-range communications (DSRC): used for EFC; commercial vehicle operations (CVO) pre-clearance.

微波、短程无线通讯和基于红外的专用短程通信（DSRC）——用于电子收费系统和商业车辆营运的预清关。

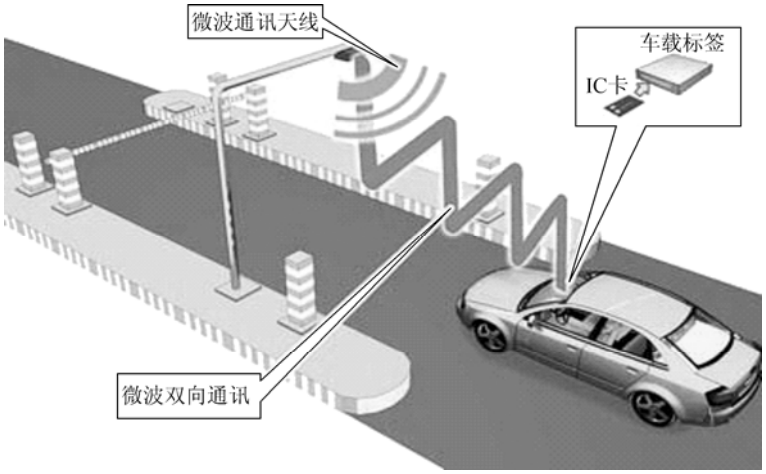

Figure 1.16　Application of microwave communication in EFC system

图 1.16　微波通讯在电子收费系统中的应用

② Mobile communications: used for real-time travel information; fleet management;