Real-Time Navigation System
A CyberRail Function

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Cars with drivers arrive at the station.

Drivers leave cars, which go to parking area automatically, for taking train.

There are no ticket wickets.

Meeting point of real and virtual space.

Cars with drivers arrive at the station.
Transport Types

- Low Efficiency ➔ High Efficiency
- Individually designed ➔ Mass oriented

- Soft
- Comfortable

GAP

Solid ???

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Restaurant VS Eating house

A la carte restaurant
Expensive, inefficient, energy consuming, ..., but attractive

Monotonous Plate dish
Cheap, fast, efficient, sustainable, healthy..., but diminishing appetite
Guiding Principle I

- REENGINEERING by Michael Hammer in 1993
- From Adam Smith’s Division of Labour
  To Coherent Business PROCESSES

Key word is **IT**, which is the precondition of this theory

- Fundamental rethinking and radical redesign of business processes
- Railways are **NOT** Process-Oriented!
- Focused on
  - Tasks, jobs, people, and structure
  - Not on process, that is, to transport a passenger from a station to a station.
Guiding Principle II

- **Inter-modal transport**

- **Cellular Phone system** uses the same principle

- Wired Communication Infrastructure
CyberRail in a word

- Division of Labour
- Mass-production (belt-conveyor)
  - Local Optimization
  
  Converted into

- Process-Oriented with IT
  - Tailor made for each individual passenger
  - Creation of feedback loop within operator’s PDCA cycle
  - Labour saving

→ KEY: Introduction of travel assistant
Before: GAP in Information cycles

- Too much Information
- No direct feedback
- Higher response time
- Difficult to find out
- Who takes care of me
- Why I have to ask again and again

Leaking

DRAIN
Travel Assistant Fills the GAP

- Enough Information
- Lots of feedback
- Efficient use of bandwidth
- Easy to find out
- I am took care of
- I only have to say once
- I only have to say once
Functions of Travel Assistant

- Guidance of travel plan
  (answering as much as you want)
  - Timetable, sightseeing, hotels reservations
- Guidance during the travel
  (like a travel conductor)
  - Guidance for operation status, connections, etc
- Fare collections (making it cheapest?)
- Information collections (for now and tomorrow)

- All the passengers white-gloved services
- Enough information of PDCA cycle
How to make it with IT

- **Individual guidance** to each passenger
  - Fundamental data for guide and fare

- **Tracing the position** of the passenger in order to give appropriate information

- **Recording movement** from the starting door to final destination

- This may cause privacy disclosure problems
  - Don’t make a jump
    - Everything has both sides

- This will be **solved** by **IT** as well
Fake identification by tracing

Card Issuer

Card holder’s home

Tracking card movement

Journey to station

Shopping

Appearance of card with same ID at different location

Quick identification of fake card
CyberRail conceptual model

Providers which offer a variety of transportation and other services

Travel Demands class

Requests to travel; current positions

guidances/advises

guidance/advises/operational directions

Real Transport Space

Cyber space

carrier class

route class

Operational status data collections

Control & maintenance

Operational & Vehicle status
User’s conceptual device “Tag” functions

Local & broadcast Communication

Location Detect or detected

Short distance Communication

Mobile Communication

Tag
Plan-Do-See cycle for railway systems
After CyberRail

Plan-Do-See cycle for railway systems

Passengers
Demands

Accidents
Failures

Become system parameters

Plan
Do
See
CyberRail conceptual model revised
(operator’s view)

Cyber space

Travel Demands class

Sales

Maintenance

Operator class

Operation

Disturbance class

Tag

Real Transport Space

Outside
An Example: New reservations
reserve partially only what is needed at the time

Month before
Booking of conceptual seats under the roughly specified conditions
Depart before noon
Tokyo

Week before
More concrete booking of seats considering time zone
11:00 ~ 12:00

Day before
Normal booking of seats at a specific train, satisfying the demands
Tokyo
Train # yyyy
Echigo Uzawa
Train # xxxx

Kanazawa

No smoking
Window

Kanazawa

No smoking
Window

15:00 ~ 16:00

The train guaranteed as usual

Seats and specifications guaranteed

Time Zone guaranteed

No smoking
Window

By the evening

JR

CyberRail  2 March 2005- 18
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CyberRail Alternative realization for privacy and transition

providers which offer a variety of transport data

Cyber space

route class

carrier class

Real Transport Space

Travel Demands class

Tag

current positions acquisition + Guidance processing

current situation of transport status + Change notification

Operational status data collections

Control & Maintenance

Operational & Vehicle status + Statistical passenger data

requests to guide

guidances/advices

operational directions

Real Transport Space
“Tag” functions for alternative

Programmable Functions for agent

Local & broadcast Communication

Location detection

Short distance Communication

Mobile Communication

Tag
Experiment: Traveler Support System

- realizes a part of the fundamental features of CyberRail
- can be operational for evaluation and testing in real field environment
- conforms to the logical architecture

Objectives of the experiment:

- Least input operations
  - Passengers have to only select an itinerary plan.
- Timely information delivery and useful contents
  - Automatic delivery of information depending upon the current location and the itinerary.
- Automatic detection of missing the train and provision of the alternative
  - Decision by passing time of AFC gate and continuation by the alternative plan
GOOPAS

• Passenger registers ID of his/her season ticket and the number of mobile phone
• Immediately after when the season ticket with ID passes through a ticket gate, an email will send to the mobile phone with the contents of:
  • (Onward/departure) What we should check or know for today’s needs
  • (Onward/arrival) Nice information depending upon personal preferences
  • (Return/departure) Light Contents with pleasure
  • (Return/arrival) local news and Information
Experiment Scenario

Odakyu Line: From Sangubashi TO Shimokitazawa

CyberRail

1. Travel plan consultation
2. Response and register
3. Reminder to leave home
4. Warning for departure
5. Gate passed
6. Before transfer station
7. Any time
8. Operation information
9. Before arrival

End message

System knows the journey has started

15:27 arr 15:19 dep
15:25 dep
15:22 arr
22nd alternative

11st alternative

Sangu-bashi
Yoyogiuehara
Shimokitazawa

15:16
15:19 dep
15:23
15:27 arr

1st alternative

2nd alternative
Message Timing Chart

If a passenger has not shown up \( \delta \) minutes prior to departure time, he/she is considered to be late for the train.

- **Registration completed**
- **Departure**
- **Immediate departure**
- **Itinerary confirmation**
- **Transfer**
- **Transfer station**
- **Destination station**
- **Arrival**
- **Itinerary completed**

**Route-Choice Support System**

**Passenger’s itinerary**

\[ \alpha \text{ minute} \]

\[ \beta \text{ minute} \]

\[ \delta \text{ minute} \]

\[ \gamma \text{ minute} \]

System Proposes an alternative itinerary
Evaluation I

● Experimental has been carried out by
  - the Railway Technical Research Institute
  - OMRON Corporation, the goopas system manufacturer
  - Odakyu Electric Railway Co. Ltd., one of the major private rail companies in the Tokyo urban area.

● From **August 2003 through March 2004**, 103 users used this system

● 67 of them have responded to the questionnaire which asked if the system is necessary, its effectiveness, suitability of the contents and the distributed timings, etc.

● The questionnaire survey shows
  - many users highly rated the services provided by the system
  - most of them were satisfied with the contents of distributed messages
Necessity of each mail

- Registration completed
- Departure
- Immediate departure
- Itinerary confirmation
- Transfer
- Arrival
- Itinerary completed

Legend:
- Necessary
- Useful
- Useless
- No answer
Satisfactory level of each mail

- Registration completed
- Departure
- Immediate departure
- Itinerary confirmation
- Transfer
- Arrival
- Itinerary completed

Satisfactory
Almost satisfactory
Unsatisfactory
No answer
Some people commented that
- the system is effective enough to be able to support novice passengers who do not use railways frequently
- One of the features which was very much appreciated by the users was the system's ability to flexibly adjust passengers' itineraries.

The survey also reveals
- they have strong needs for
  - large-scale information and guidance at complicated stations
  - the right platform information to take the train
  - guidance when traffic becomes abnormal
- It was also pointed out
  - information delivery by e-mail to cellular phones is not dependable
  - Programs on a cellular phone may be desirable
Augmented Experiment by MLIT
CyberGuide

• Real-time Itinerary Guidance System with Adjustment
  ➢ Reinforced experiment following CyberRail experiment for IC card Urban Transport

• Concept
  ➢ Personal Navigation System with **IC cards and Mobile phones**
  ➢ **Intermodal** transport door-to-door guidance
  ➢ Push-type information provision according to **itinerary & position**
  ➢ Measures in case of missing trains or delays
  ➢ Multi-lingual system
  ➢ **To smoothly bridge transport modes**
Reinforced experiment following CyberRail for IC card Urban Transport
Real-time Itinerary Guidance System with Adjustment

Concept

- Navigation System with IC cards and Mobile phones
- Intermodal transport door-to-door guidance
- Push-type information provision according to itinerary
- Measures in case of missing trains or delays
- Multi-lingual system

Promotion of Public Transport Usage
⇒ Sustainable & Environmentally Friendliness

Overseas Tourists Convenience
⇒ Promotion of Visit Japan

Real-time Itinerary Correction needs:
- Standardized interface to transport operator systems to receive current state of data
- Standardized interface with users
- Standardization of Transport related data

Itinerary Planning

Input where to go ⇒ Routes shown and registered

Real-time Itinerary Guidance System

Optimal route search system developed by MLIT

System construction
- Experiment
- Standardized data format
- Connection Specification
- Standardized interface
- Multilingual information

Real-time Itinerary Guidance System

Route search
- Timetable
- Public Transport Operators

Operation Status
- Bus location systems (Bus Operators)
- Train operation information (Railway operators)

User locations
- IC card Bus Fare Collection (Bus operators)
- IC card Fare Collection (Railway operators)

Cooperation with existing assets

Passenger Navigation with Map

Get off bus

Receive real-time
information

Receive real-time
information

Bus or walking

Depart from
Airport

Enter with IC card

Receive Map

Leaving with IC card

Bus or walking

Arrival

Depart

Receive real-time
information

Real-time information
before departure

Route registration

Walk or walking
Real-time Navigation System

A CyberRail Function

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