# DESCRIPTION

## Title of Invention

PASSENGER GUIDANCE SYSTEM AND PASSENGER GUIDANCE METHOD

## Technical Field

[0001]

The present invention relates to a calculation technique and system that expedite passenger guidance and accomplish congestion mitigation during transportation disturbance by taking advantage of transportation network IC card data to extract passengers who will be affected by the transportation disturbance and to deliver information processed on a per-user basis.

## Background Art

[0002]

The recent years have seen frequent occurrence of rail transport disturbances due to decrepit transportation infrastructure and the like. The mitigation of congestion in a station is one of the problems to be solved because passenger jam in the station involves the risk of accident. One of the solutions is to deliver information to passengers. The delivery of information about an accident and an alternative route to passengers is expected to

reduce the inflow of passengers into the station and to increase the outflow of passengers from the station. However, it is difficult to predict passengers' behaviors and is also difficult to identify passengers to be affected by the accident. Even in a case where the identification of passengers to be affected by the accident and the delivery of information about the alternative route can be accomplished, some area in the station on the alternative route may be congested with the passengers who are crowding toward the alternative route. In view of the above fact, Patent Literature 1 discloses a system where in the event of a transportation disturbance on a movement route previously registered by a user, the information about accident and the like is delivered to the user.

Citation List

Patent Literature

[0003]

PTL 1: Japanese Patent Application Laid-Open No. 2012-215585

Summary of Invention

Technical Problem

[0004]

At the time of transportation disturbance, the station will often be crowded with passengers having no information about the disturbance. It is therefore expected that the congestion in the station is mitigated by offering information about the alternative route to the passengers. However, it is difficult to predict the movement of the passengers. This makes it difficult to identify the passengers to be affected by the transportation disturbance and to deliver the information to the passengers. According to the technique disclosed in the above patent literature 1, the system determines whether or not a passenger is affected by the transportation disturbance by referring to a movement route and time slot previously registered by a user and searching the route. However, the user needs to access the system in order to register or change the route, which is cumbersome. According to the technique disclosed in the above patent literature 1, the information about the alternative route is delivered to the passengers. This involves a fear that the station will be congested with the passengers who are crowding toward the alternative route.

[0005]

The present invention has been made in view of the foregoing, and an object thereof is to provide a system

and method that permit the user to readily know a suitable alternative route for the user in the event of a transportation disturbance and permit a railway business operator to obviate the congestion during the transportation disturbance.

Solution to Problem

[0006]

According to an aspect of the invention for solving the above problem and achieving the object, a passenger guidance system for guiding a passenger moving via a route using an IC card, includes: a behavior pattern extraction section that by referring to movement log data recording a movement history of the user which includes usage date and time of a transportation system and a route, outputs a behavior pattern of the user; a passenger extraction section that by referring to the usage date and time and the route included in the behavior pattern, and accident information data including an accident section, an accident time and an operation restart time, extracts a user, out of the users, as an accident-affected user whose route includes the accident section and whose usage date and time includes the accident time, and then determines an alternative route for the user based on the route of the extracted user and master operation information of the

transportation system; an information delivery section that transmits to a terminal of the extracted user information delivery data including the alternative route; and a behavior determination section that by referring to the movement log data and the alternative route, determines whether or not the user receiving the information delivery data moved via the alternative route at the time of accident, and records the determination result in accident-time behavior pattern data.

[0007]

Further, the invention is also construed as a passenger guidance method implemented in the above passenger guidance system.

## Advantageous Effect of Invention

[0008]

The present invention permits the user to readily know a suitable alternative route for the user at the time of transportation disturbance and permits the railway business operator to prevent the congestion during the transportation disturbance.

## Brief Description of Drawings

[0009]

Fig. 1 is a block diagram illustrating an operation

flow of a system carrying out the invention.

Fig. 2 is a base configuration diagram of the whole system carrying out the invention.

Fig. 3 is a chart illustrating a configuration of a record containing usage history information of a transportation network IC card.

Fig. 4 is a chart illustrating a configuration of a record containing basic information including station, train/bus line, route and purchasing place.

Fig. 5 is a chart illustrating a configuration of a record containing accident-time movement patterns.

Fig. 6 is a chart illustrating a configuration of a record containing movement log and purchase log data generated from the usage history of the transportation network IC card.

Fig. 7 is a chart illustrating a configuration of a record containing data of the transportation network IC card and mail address of a user registered to the system.

Fig. 8 is a chart illustrating a configuration of a record containing data of accident line, accident section, and accident time, and operation restart time.

Fig. 9 is a chart illustrating a configuration of a record containing data of card ID, alternative route, accident-time movement pattern of a passenger affected by an accident, and estimated time of encounter.

Fig. 10 is a chart illustrating a configuration of a record containing data of the accident-time movement pattern.

Fig. 11 is a chart illustrating a configuration of a record containing information delivery data.

Fig. 12 is a flow chart showing the steps of an operation of generating the movement log and purchase log from the transportation network IC card data.

Fig. 13 is a flow chart showing the steps of an operation of generating behavior pattern data from the movement log data.

Fig. 14 is a flow chart showing the steps of an operation of generating data on passengers affected by transportation disturbance from accident information and the movement pattern data.

Fig. 15 is a flow chart showing the steps of an operation of generating congestion rate data of each transport system from the movement log data.

Fig. 16 is a flow chart showing the steps of an operation of generating accident-time congestion rate data from the behavior pattern data, the movement log data, accident-time movement pattern data, and the accident information.

Fig. 17 is a flow chart showing the steps of an operation of generating accident-time behavior pattern

data from the movement log and purchase log data and the information delivery data.

Fig. 18 is a chart showing an example of a screen displaying information delivered to a system user.

Fig. 19 is a chart showing an example of a screen displaying boxes for recipient number input, delivery condition input, and delivery time input, and for decision between to deliver information and not to deliver information.

Fig. 20 is a chart showing an example of a screen for checking an accident-time flow of passengers, the number of delivered mails, breakdown of behavior patterns, and rate of passengers taking the alternative route.

Fig. 21 is a chart showing an example of a screen for re-searching the alternative route.

Fig. 22 is a chart illustrating a configuration of a record containing the behavior pattern data.

Description of Embodiment

[0010]

A passenger guidance system and a passenger guidance method according to an embodiment of the invention will hereinbelow be described in detail with reference to Fig. 1 to Fig. 21.

[0011]

Fig. 1 is a block diagram illustrating an operation flow of this system. First, the system generates movement log data and purchase log data (101) when movement or a transaction such as purchasing by means of transportation network IC card data (100) is made. The movement log data and the purchase log data (hereinafter, these are collectively referred to as movement and purchase log data at times) are data retaining a history of a user moving or purchasing some goods by means of the transportation network IC card. The following description is made on a case where the user uses the transportation network IC card for purchasing some goods as an example of use of the transportation network IC card for the purpose other than that of moving. However, the IC card is similarly applicable to cases where the user adopts various behaviors other than moving, such as where the user uses a service or charges the card. The movement log data and purchase log data may be sequentially generated in conjunction with the update of the transportation network IC card data of the system. Otherwise, the movement log data and purchase log data may be periodically generated by a batch process. The operation flow of the system is roughly divided into three operations including an operation before accident (120), an operation during accident (130) and an operation after accident (140).

[0012]

Before an accident (120), the system generates behavior pattern data (121) by extracting passenger-specific movement route and time slot from the movement log data and purchase log data. The behavior pattern data is data recording previous behaviors of the user, namely when in past times the user moved or purchased some goods by means of the transportation network IC card. Further, the system estimates the number of passengers from the movement log data before the accident (120) so as to calculate a congestion rate (122) and stores the calculation result in database. Further, the system registers the information of the transportation network IC card and mail address (123) so as to generate registrant data (124). A user registered in the registrant data is the user of this system.

[0013]

During the accident (130), the system acquires the behavior pattern data and accident information (131) and extracts a passenger to be affected (132) from the movement log data and the purchase log data. The accident information is data recording information about a railway business operator and an accident in question. In response to an information delivery instruction (133) from the railway business operator, the system refers to the

registrant data so as to deliver alternative route information (134) to the affected passenger. The alternative route information is information recording the alternative route that the system determines from a previous behavior of each passenger. At this time, the system determines the congestion rate of the alternative route and generates accident-time behavior pattern data (125). The system decides the accident-time behavior pattern of each passenger from these information items and affixes information according to the resultant behavior pattern. The accident-time behavior pattern data is data recording previous accident-time behavior pattern of the passenger.

[0014]

After the accident, the system estimates a post-accident behavior of the passenger from the movement log data and purchase log data (141), and updates the accident-time behavior pattern data (142). By updating the accident-time behavior, the system can deliver an accurate congestion rate and proper information to the user.

[0015]

Fig. 2 is a block diagram showing the overall configuration of the system. A passenger (200) utilizing the transportation system uses a transportation network IC card (201) or a portable terminal (204) having an

equivalent function so as to pass a ticket gate or a reader terminal (202) installed in a vehicle. Those ticket gates and in-vehicle terminals acquire data from the transportation network IC cards (201) and portable terminals (204). The acquired data is transmitted to multiple servers (210) managed by the respective transportation business operators via a network (207). The system (208) includes a data server (210), a compute server (230), and an information delivery server (250). The system accumulates data on the usage of the transportation network IC cards (201) and the portable terminals (204) of the equivalent function and performs an analytical processing. It is noted that the description on the functions and configurations of the transportation network IC card and ticket gates is dispensed with because a variety of media and devices conventionally used in the art are usable. While the following description is made on assumption that the transportation system is railway, the system is also applicable to users (205) of other transportation systems such as bus (203) and taxi (206).

[0016]

When the user (200) with the transportation network IC card (201) passes the ticket gate (202), information items including a card ID for identification of the transportation network IC card and the date and time of

passage are accumulated in the ticket gate (202). Necessary information is transmitted to the data server (210) at the time of passage or at an interval of one hour or one day. The system (208) can communicate with a user (281) via a network (273). In this embodiment, the data server (210), the compute server (230), and the information delivery server (250) are described as the server group. However, the system may employ a single server for performing all the operations. Alternatively, the system may employ the multiple servers which are configured to implement their functions in parallel.

[0017]

The data server (210) records user data in a database (211) therein, the user data read by the ticket gate (202) or an IC card reader terminal (not shown) installed at a shop and the like. The collected and stored data includes transportation network IC card data (212) and basic master data (213) about station, bus stop, train/bus line and the like. The collected and stored data further includes movement and purchase log data (214) resulting from the processing of the transportation network IC card data (212), and behavior pattern data (215) composed of passenger-specific movement data generated by collecting and analyzing movement log data. The collected and stored data further includes: accident information data (216)

inputted by the railway business operator or the like at the time of a transportation disturbance; and accident-time behavior pattern data (217) generated by analyzing the movement and purchase log data (214) on a per-IC-card basis.

[0018]

The collected and stored data further includes an accident-time behavior pattern table (218) which previously categorizes accident-time behavior patterns. The data server also stores information delivery data (219) containing contents of information delivered to the users of the system. The server further stores registrant data (220) including the transportation network IC card data (212) of the users, and the transportation network IC card IDs and mail addresses for delivering the information to the users. The following description is made on assumption that the above-described data items are stored in the database (211) in an HDD (Hard Disk Drive). However, the data items may be stored in a CD-ROM drive or a flash memory so as to be written or read out by the system. Further, respective programs and respective data items may be separately recorded in multiple recording devices. This applies to the compute server (230) and the information delivery server (250) to be described hereinlater.

[0019]

The compute server (230) principally performs a processing of generating the movement and purchase log from the data accumulated in the data server (210), a processing of estimating the congestion rate of the transportation system, a processing of extracting the behavior pattern on the movement route of the user, a processing of extracting the passenger affected by the transportation disturbance, and a processing of determining the post-accident behavior. The compute server (230) principally includes a network interface (I/F A) (231), a CPU (232), a memory (232), and a storage unit (239).

[0020]

The network interface (I/F (A)) (231) is an interface for connection to a network. The database (239) stores multiple programs which include a movement and purchase log generation program (234), a congestion rate estimation program (235), a behavior pattern extraction program (236), an affected passenger extraction program (237), an accident-time behavior determination program (238) and the like, and calculation results such as affected passenger data (241) on passengers affected by the transportation disturbance and generated by the affected passenger extraction program (237).

[0021]

When each of the multiple programs is implemented, data as an analysis subject is retrieved from the data server (210) and temporarily stored in a memory (233), while each of the functions is implemented by the CPU (232)that runs the program (234, 235, 236, 237, 238) read into the memory. Time to run these programs, for example, is when a request is made or whenever new data is added. Otherwise, the programs may be automatically run at a regular time every day as a batch process. In a case where the data as the analysis subject is transmitted in real time, the program (234, 235, 236, 237, 238) may be run so as to process only difference data newly added.

[0022]

The information delivery server (250) includes a network interface (I/F (B)) (251), a CPU (253), a memory (254) and a database (252). The network interface (I/F (B)) (251) is an interface for connection to the network. The database (252) records a variety of programs and data items. Similarly to that of the compute server (230), the CPU (253) implements each of the functions by running each of the programs (simulation program (255), display screen generation program (256)) stored in a recording device (252) and read into the memory (254).

[0023]

The system (208) delivers generated alternative route

information and information items including congestion rate, simulation result and the like to a business operator (272) via an interface (I/F (C)) (258) and a network (270), while the business operator can transmit an information delivery instruction to the system or can input, to the system, the accident information, the number of mails to be delivered and condition setting for passenger to whom information is delivered. Further, the system can deliver the alternative route information and the like to the user (281) via the network (273). The user can acquire the information by means of an information terminal (282) such as the portable terminal.

[0024]

Fig. 3 is a chart showing an example of the transportation network IC card data (212) stored in the data server (210). As shown in Fig. 3, the transportation network IC card data (212) includes information items: a log ID (301) for identification of history of movement or purchase; a card ID (302) for identification of the transportation network IC card; a station/bus stop ID (303) for identification of a station or bus stop installed with the reader terminal passed by the user (entry or exit); usage and purchase date and time (304) indicating date and time when the user started the use of transportation system at a point of departure or date and

time when the user made a purchase; a type of usage (305) for identification of a type of processing performed by the reader terminal used; a purchasing place ID (306) indicating a place where the user purchased some goods or used a service by means of the transportation network IC card; an amount of payment (307) for movement to some place or purchase of some goods; and the like. Fig. 3 indicates, for example, that using the transportation network IC card identified by a card ID "1234567", a user entered a station "10001" at 12:00 on January 1, 2009 so that 200 yen was debited from a transportation network IC card account and the behavior was saved as a record identified by a log ID "87654000". The chart also indicates that using another card identified by a card ID "1234569", another user purchased some goods or used some service at a shop identified by a purchasing place ID "50001" at 12:31 on January 1, 2009 so that 200 yen was debited from a transportation network IC card account. In this manner, the transportation network IC card data (212) contains, in conjunction with the user, the details of the behavior of the user using the transportation network IC card.

[0025]

Fig. 4 is a chart illustrating types of master data items (213) stored in the data server (210) and an example

of respective data configurations. As shown in Fig. 4, the master data items (213) include: a station/bus stop master (410) for identification of a station or bus stop; a line master (420) for identification of a line of transportation system such as railway and bus; a schedule master (430) representing master data of a schedule of the transportation system such as railway and bus; a route master (440) representing a route between a departure point to an arrival point; and a purchasing place master (460) representing a place where a user purchased some goods or used some service by means of the transportation network IC card. The master data items except for the purchasing place master (460) are master data related to the operation of the transportation system.

[0026]

As shown in Fig. 4, the station/bus stop master (410) contains information items in conjunction with the user, which include: a station/bus stop ID (411), a station/bus stop name (412) identified by the ID thereof, a holding company (413) (normally a holding company of a railway/bus line) of the station/bus stop, a location of the station/bus stop (414), information of latitude and longitude of the location (415), and the like. Fig. 4 indicates, for example, that a station A owned by a holding company "oo" is located at "-- oo City, oo

prefecture" and the latitude and longitude of the location are "139,xx, 34,xxx". The chart also indicates that this station A is identified by a station/bus stop ID "10001".

[0027]

The line master (420) contains information items in conjunction with the user, which include: a line ID (421), a name of the line (422), a name of the operating company of the line (423), a line type (424) indicating the type of operated railway or bus such as railway local train and route bus, a riding capacity (425) of the train of the line type, and the like. Fig. 4 indicates, for example, that local trains of a line x identified by a line ID "200001" are operated by an operating company "oo" and a local railway train having a riding capacity of up to 500 passengers runs.

[0028]

The schedule master (430) contains information items in conjunction with the user, which include: a line ID (431), a station/bus stop ID (432), an order (433) indicating what number on the line the station/bus stop is, a departure time (434) to depart from the station/bus stop, an arrival time (435) to arrive at the station/bus stop, a required time (436) from the starting point of the line, and the like. Fig. 4 indicates, for example, that on a line identified by a line ID "2002", a train or bus runs

in the order from a station identified by a station/bus stop ID "10001" to the next station identified by a station/bus stop ID "10002". The chart also indicates that a required time for the travel is 10 minutes and the arrival time is 12:10. It is noted that the first record is on a starting station and hence, indicates the same departure time as that of the next record.

[0029]

The route master (440) contains information items in conjunction with the user, which include: a route ID (441) for identification of a route between from boarding station or bus stop to an exit station or bus stop; a boarding station/bus stop ID (442); an exit station/bus stop ID (443) and the like. The route master (440) further includes: a line ID (444) corresponding to the number of transfers to travel from a departure point to a destination; and a transfer station/bus stop ID (445); and an exit station/bus stop ID (446). Finally, the route master contains information items in conjunction with the user, which include: the number of lines (447) used to travel from the departure point to the destination; an average required time (448)to travel from the departure point to the destination; a fare (449) and the like. Fig. 4 indicates, for example, that a route identified by a route ID "30002" is a route where in order to travel from

a boarding station/bus stop, as a departure point, identified by a boarding station/bus stop ID "10001" to an exit station/bus stop, as a destination, identified by an exit station/bus stop ID "10031", the user first transfers to a line identified by a line ID "20002" to move from a boarding station/bus stop (boarding station/bus stop ID "10002") to an exit station/bus stop (exit station/bus stop ID "20004") and then takes four transfers before arriving at the destination. Further, the chart indicates that an average time required to travel from the departure point to the destination is 42 minutes and the fare is 520 yen.

[0030]

The purchasing place master (460) contains information items in conjunction with the user, which include: a purchasing place ID (461) representing a place to purchase some goods or use some service; a name of shop at the purchasing place (462); a location of the shop (463); latitude and longitude of the location (464); a shop type (465) such as convenience store and vending machine; and the like. Fig. 4 indicates, for example, that a shop "oo mart" identified by a purchasing place ID "50001" is located at "-- oo City, oo prefecture" and the latitude and longitude of the location are "140,xxx, 35,xxx". The chart also indicates that this shop is a

convenience store. The contents of the master data (400) are subjected to data addition or correction as needed by means of an operation terminal (271) possessed by the business operator (272).

[0031]

Fig. 5 is a chart illustrating an example of a data configuration of the accident-time behavior pattern table (218) stored in the data server (210). As shown in Fig. 5, the accident-time behavior pattern table (450) contains information items in conjunction with the user, which include: an accident-time behavior pattern ID (451); contents (452) of behavior patterns obtained by patterning passengers' behaviors at the time of accident, which include: moving via an alternative route according to delivered information to be described hereinlater, moving without using the alternative route suggested by the delivered information, moving by utilizing another transportation system such as taxi or bus, making a purchase outside a station, staying in the vicinity of the station, and eating and drinking at a shop in the vicinity of the station; a determination method (453) for determining the accident-time behavior of the user based on the movement and purchase log data (214); and the like. Fig. 5 indicates, for example, that in a case where the user adopts a behavior of moving via the alternative route

suggested by the delivered information, the behavior is identified by an accident-time behavior pattern ID "1". Fig. 5 also indicates that in a case where the delivered information is checked against the movement and purchase log data (214) and the alternative route contained in the delivered information is found in the log data of interest, it is determined that the user used the alternative route. In a case where the departure point and the arrival point in the movement and purchase log data (214) are discontinuous, it is determined that the user transferred at some station on the way. Otherwise, it is determined that the user adopted a behavior of using another transportation system (accident-time behavior pattern ID "3") (for example, the behavior of using a bus or taxi or otherwise, a line of another railway company if the user utilized some other railway line). In a case where the movement and purchase log data (214) contains an eating and drinking log, it is determined that the user waited purchasing some goods or eating/drinking at some place outside the station (accident-time behavior pattern ID "4", ID "5"). Otherwise, it is determined that the user stayed in the station (accident-time behavior pattern ID "6").

[0032]

Fig. 6 is a chart illustrating an example of a data configuration of the movement and purchase log data (214)

stored in the data server (210). The movement and purchase log data (214) includes movement log data (510) and purchase log data (530). The movement log data (510) includes: a log ID (511) for identification of the movement log; a card ID (512) of the user that made a movement; boarding date and time (513) indicating the date and time to start using the transportation system at the departure point; exit date and time (514) indicating the date and time to end the use of the transportation system at the arrival point; a boarding station/bus stop ID (515) indicating the station or bus stop where the user went on board at the boarding date and time; an exit station/bus stop ID (516) indicating the exit station/bus stop where the user exited at the exit date and time; and an amount of payment (517). In case that the user changed transportation systems, the log data further includes in conjunction with the user: a route ID (518) corresponding to each of the lines connected; and boarding date and time (519), exit date and time (520), a boarding station/bus stop ID (521), an exit station/bus stop ID (522) and the like which are equivalent to the above-described items. Fig. 6 indicates, for example, that the user of the transportation network IC card identified by the card ID "1234567" went on board at a station/bus stop identified by "90001" at 12:30 on August 26, 2013 and exited at a

station/bus stop identified by "90002" at 13:25 of the same day and hence, 200 yen was debited from the transportation network IC card account. The chart further indicates that before arrival at the destination, the user took a transfer at a station/bus stop identified by a station/bus stop ID "10003" on a route identified by a route ID "30003" at 12:35 of the same day, exited a station/bus stop identified by a station/bus stop ID "100004" at 12:40 of the same day and further transferred to a transportation system on a route identified by a route ID "30001" (the same applies to the subsequent transfer). While Fig. 6 does not particularly show each payment amount, the payment amount is logged for each change of route (per route ID1, per route ID2, for example). Fig. 6 also indicates that a log ID of this record is "70001A".

[0033]

The purchase log data (530) contains information items in conjunction with the user, which include: a log ID (531) for identification of the purchase log; a card ID (532) of the user making a purchase; purchase date and time (533) indicating the date and time in a purchasing history; an amount of payment (534) at the time of purchase; a purchasing place ID (535) for identification of a purchasing place; and the like. Fig. 6 indicates, for

example, that the user of the transportation network IC card identified by the card ID "1234567" made a purchase at a purchasing place identified by "50001" at 12:32 on August 26, 2013 and 200 yen was debited from the transportation network IC card account of the user. Fig. 6 also indicates that a log ID of this record is "70001B". This indicates that the user of the transportation network IC card identified by the card ID "1234567" went into the boarding station/bus stop identified by "90001", purchased some goods at the purchasing place (such as a convenience store in the station) identified by "50001" two minutes later and then, got on board.

[0034]

Fig. 7 is a chart illustrating an example of a data configuration of the registrant data (220) stored in the data server (210). The registrant data (220) contains information items in conjunction with the user, which include: a registrant ID (601) for identification of a registrant as the user of the system; a card ID (602) of the transportation network IC card for identification of transportation network IC card data (212) of the registrant; a mail address (603) as a destination address to which information is transmitted at the time of transportation disturbance; and the like. The card ID 602 of the transportation network IC card is used for

extracting information of the registrant from the transportation network IC card data 212, for example. Fig. 7 indicates, for example, that a user of a registrant ID "100001" uses a transportation network card identified by a transportation network card ID "123451" and has a mail address "aaa@abc.com". Information delivery data to be described hereinlater is delivered to this address.

[0035]

Fig. 8 is a chart illustrating an example of a data configuration of the accident information data (220) stored in the data server (210). The accident information data (220) contains information items in conjunction with the user, which include: an accident ID (701) for identification of an accident occurred such as transportation disturbance; a line ID (702) indicating a line involved in the accident; an accident section A (703) representing a start station/bus stop of the accident section; an accident section B (704) representing an end station/bus stop of the accident section; an accident time (705); and an operation restart time (706). Fig. 8 indicates, for example, that at 11:00 on August 26, 2013, an accident occurred at a section between station A and station B on a line identified by a line ID "1001" and an operation restart time is estimated to be 12:30 of the same day. The accident information data (220) is

previously defined by the business operator (272). As will be described hereinlater, the accident information data may include days of week such as to facilitate the identification of the passenger affected by the transportation disturbance based on the accident information data (220) and the behavior pattern data (215). In this case, an accident time slot and the day of week are used as a key to identify the affected passenger. Therefore, the affected passenger can be identified more quickly in a case where there are a large number of passengers who move around often via a variety of routes.

[0036]

Fig. 9 is a chart illustrating an example of a data configuration of accident-affected passenger data (218) stored in the data server (210). The accident-affected passenger data (218) contains information items in conjunction with the user, which include: an accident ID (801); a card ID (802); and estimated date and time of encounter (805) when the affected passenger may encounter an accident. In case that the user moves to the destination by circumventing a transportation disturbance section, the data contains information items in conjunction with the user, which include: an line ID (804), boarding date and time (805), exit date and time (806), a boarding station/bus stop ID (807) on the alternative

route, and an exit station/bus stop ID (808) on the alternative route, which correspond to each of the number of lines used on the alternative route. Fig. 9 indicates, for example, that a user of a card ID "10001" may adopt an alternative route where the user gets on board at a station/bus stop identified by an ID "10003" on a line identified by a line ID "3003" at 11:45 on August 26, 2013 and exits at a station/bus stop identified by an ID "1101" at 12:00 of the same day. The estimated date and time of encounter when the user is expected to encounter an accident at the accident section recorded in the accident information data (216) is calculated by referring to departure time and arrival time recorded in the behavior pattern data (215) shown in Fig. 22 to be described hereinlater, and the schedule master (430) and the line master (440) shown in Fig. 4. In Fig. 9, the accident-affected passenger data (218) includes the line ID. However, the accident-affected passenger data actually includes the route ID just as shown in Fig. 6.

[0037]

Fig. 10 is a chart illustrating an example of a data configuration of the accident-time behavior pattern data 217 stored in the data server (210). The accident-time behavior pattern data (217) contains information items in conjunction with the user, which include: a card ID (901);

an accident ID (902); a previous accident-time behavior pattern ID (903); and an alternative route (904) that the user of the card ID actually used at the accident time. The actually used alternative route contains the same contents as the movement log data (510) shown in Fig. 6. Fig. 10 indicates, for example, that when a user of a transportation network IC card identified by a card ID "100001" encountered an accident identified by an accident ID "20001", the user adopted a behavior identified by a behavior pattern ID "1", circumventing via an alternative route (904) actually used at the accident time. With regard to Fig. 10, the description is made on assumption that the most recent behavior pattern is saved. However, in order to grasp the characteristics of the user, the behavior pattern may be retrospectively saved in the form of history. This makes it possible to determine what characteristic the user has (whether or not the user circumvents according to the delivered information, or that the user does not like moving on but tends to wait and see).

[0038]

Fig. 11 is a chart illustrating an example of a data configuration of the information delivery data (219) stored in the data server (210). The information delivery data (219) contains information items in conjunction with

the user, which include: an accident ID (1001); a registrant ID (1002) of a passenger to whom the information was delivered; date and time of delivery of the data (1003); and a behavior pattern ID (1004) of a previous accident-time behavior pattern of the registrant. Similarly to the accident-affected passenger data (218) shown in Fig. 9, this data includes an alternative route with an estimated boarding date and time as a departure time (1005 to 1009) which includes: boarding date and time (estimated boarding date and time) calculated from the behavior pattern data shown in Fig. 22, exit date and time (estimated exit date and time), a boarding station/bus stop ID, a line ID and the like. Fig. 11 indicates that information items including the accident-time behavior pattern at the previous accident time identified by the accident ID "20001", the same alternative route as that of Fig. 9 and the like were delivered to the user of the registrant ID "100001" at 11:45 on August 26, 2013. Time to actually deliver the delivery information to the user is decided by the business operator as needed. Specifically, the delivery information is delivered at a time set by means of a screen (Fig. 19) of the operation terminal (271) of the business operator which will be described hereinlater or when a delivery button is pressed down. Referring to the delivered information, the user can

find an alternative route suitable for the user.

[0039]

Fig. 12 is a flow chart showing the steps of an operation (log data acquisition processing) of generating the movement log and purchase log data (101) from the transportation network IC card data (100) and storing the resultant data in the data server (210). The description is made on assumption that the operation of saving the data in the data server 210 is performed once a day at a regular time by a batch process. However, the time to perform the process can be set as desired.

[0040]

First, the movement and purchase log generation program (234) of the compute server (230) retrieves the transportation network IC card data (212) from the data server (210) (Step 1100). Next, the movement and purchase log generation program (234) sorts the records by the card ID and by the usage and purchase date and time contained in the retrieved transportation network IC card data (212) (Step 1101).

[0041]

The movement and purchase log generation program (234) reads in the sorted record of the transportation network IC card data (212) (Step 1102), and determines whether or not the usage type of the read record falls

under "purchase" (Step 1103).

[0042]

If the movement and purchase log generation program (234) determines that the usage type of the read record is "purchase" (Yes in Step 1103), the program acquires information items including the card ID, usage and purchase date and time, payment amount, and purchasing place ID from the record so as to generate the purchase log data shown in Fig. 6 (Step 1110).

[0043]

On the other hand, if the movement and purchase log generation program (234) determines that the usage type of the read record is not "purchase" (No in Step 1103), the program further determines whether or not the usage type of the read record is "entry" (Step 1104). If it is determined that the usage type of the read record is "entry" (Yes in Step 1104), the program acquires the card ID, station/bus stop ID, usage and purchase date and time, and payment amount from the record (Step 1105).

[0044]

On the other hand, if the movement and purchase log generation program (234) determines that the usage type of the read record is not "entry" (No in Step 1104), the program determines that the usage type of the read record is "exit" and acquires the user ID, station/bus stop ID,

usage and purchase date and time, and payment amount from the record (Step 1106).

[0045]

The movement and purchase log generation program (234) determines whether or not the read record is the last one (Step 1107). If it is determined that the read record is not the last one (No in Step 1107), the program returns to Step 1102. On the other hand, if it is determined that the read record is the last one (Yes in Step 1107), the program generates the movement and purchase log data (214) from the acquired data and stores the resultant data in the data server (Step 1108). Subsequently, the program ends the processing (Step 1109).

[0046]

At this time, the movement and purchase log generation program (234) determines whether or not the movement was made by the same user (namely, one movement by a certain user). If it is determined that one movement was made, the boarding date and time and the exit date and time are recorded in one record. The determination on whether or not the number of movements is one is made based on whether or not the transportation network IC card data pieces of the same card ID are recorded in time slots (e.g., one hour) before and after the boarding date and time or the exit date and time. If the same card ID is not

recorded in time slots (e.g., one hour) before and after the boarding date and time or the exit date and time, the records of the same card ID prior to the boarding time or the exit time are determined to mean one movement. A log ID for each of the movement log data and of the purchase log data is defined so as to uniquely represent records. When this processing ends, a processing of estimating a behavior pattern (to be described hereinlater) is performed.

[0047]

Fig. 13 is a flow chart showing the steps of an operation (behavior pattern estimation processing) of generating the behavior pattern data from the movement log data (510) shown in Fig. 6 and storing the resultant data in the data server.

[0048]

First, the behavior pattern extraction program (236) retrieves the movement log data generated by the processing of Fig. 12 (Step 1200). Next, the behavior pattern extraction program (236) sorts the records by the card ID and by the boarding time which are contained in the movement log data (Step 1201) and reads in one record of the sorted movement log (Step 1202).

[0049]

The behavior pattern extraction program (236)

acquires the card ID, the route ID, the boarding station/bus top ID, the exit station/bus stop ID, the boarding date and time, and the exit date and time contained in the record (Step 1203). The behavior pattern extraction program (236) identifies records of the same combination of the route ID, the boarding station/bus top ID, and the exit station/bus stop ID by each card ID, and compares the boarding dates and times and the exit dates and times with unillustrated calendar information so as to calculate average values of the boarding dates and times and the exit dates and times for each day of the week (Step 1204). In a case where plural Mondays are included in a period to which the system is applied, for example, respective average values of the boarding times and the exit times of the plural Mondays are calculated and compiled. In a case where a user of the same card ID moved via different routes on the same day of the week, the data pieces are sequentially added to the related record similarly to the case of the movement log data. It is noted that the calendar information may be retained by the system or otherwise, may be information commonly and widely used and downloaded via a network.

[0050]

Subsequently, the behavior pattern extraction program 236 determines whether or not the read record is the last

record (Step 1205). If the read record is not the last record (No in Step 1205), the program returns to Step 1202 and repeats the subsequent steps.

[0051]

On the other hand, if the read record is the last record (Yes in Step 1205), the behavior pattern extraction program (236) generates the behavior pattern data outputting the card ID, the day of week, the boarding date and time, the exit date and time, the boarding station/bus stop ID, the exit station/bus stop ID and the route ID, and stores the behavior pattern data in the database (211) of the data server (210) (Step 1206).

[0052]

Fig. 22 is a chart illustrating an example of a data configuration of the behavior pattern data (215) stored in the data server (210). As shown in Fig. 22, the behavior pattern data (215) contains information items in conjunction with the user, which include: a card ID (2101), a day of week (2102), boarding date and time (2103), a boarding station/bus stop ID (2104), an exit station/bus stop ID (2105), a route ID (2106), and exit station/bus stop ID (2107). Fig. 22 indicates, for example, that the user identified by the card ID "10001" moves via a route identified by a route ID "30001" where the user gets on board at a boarding station/bus stop identified by a

boarding station/bus stop ID "90001" at 07:00 every Monday and exits at an exit station/bus stop identified by an exit station/bus stop ID "90011" at 08:00. In a case where this user further moves via another route on Monday, these information pieces are sequentially added to the record similarly to the movement log data. Such a processing generates records for each card ID or for each day of week, which make the behavior pattern of each user on each day of the week comprehensible. Next, description is made on a processing of generating affected passenger data (241) about passenger affected by an accident such as transportation disturbance.

[0053]

Fig. 14 is a flow chart showing the steps of an operation (passenger data generation processing) of generating the affected passenger data (241) from the movement log and storing the resultant data in a storage unit. The following description is made on assumption that an accident such as transportation disturbance occurred at a certain section of a transportation system before this processing and hence, the accident information data (216) as shown in Fig. 8 was stored in the data server (210) by the business operator.

[0054]

The affected passenger extraction program (237) first

retrieves the accident information data (216) and the behavior pattern data (215) (Step 1300). Subsequently, the affected passenger extraction program (237) sorts records by the card ID and by the boarding date and time contained in the behavior pattern data (215) (Step 1301) and reads in one record of the sorted behavior pattern data (215) (Step 1302).

[0055]

The affected passenger extraction program (237) determines whether or not a route of the route ID of the behavior pattern is included in an accident section of the accident information data, and whether or not a time slot from the boarding date and time to the exit date and time of the behavior pattern data (215) is included in a time slot from the accident time to the operation restart time of the accident information data (216) (Step 1303).

[0056]

If the affected passenger extraction program (237) determines that the time slot of interest is included in the time slot from the accident time to the operation restart time of the accident information data (216) (Yes in Step 1303), the program stores the record in memory as the passenger affected by the accident (Step 1304).

[0057]

On the other hand, if the affected passenger

extraction program (237) determines that the time slot of interest is not included in the time slot from the accident time to the operation restart time of the accident information data (216) (No in Step 1303), the program returns to Step 1302 and repeats the subsequent steps.

[0058]

The affected passenger extraction program (237) determines whether or not the read record is the last one (Step 1305). If it is determined that the read record is not the last one (No in Step 1305), the program returns to Step 1302 and repeats the subsequent steps.

[0059]

On the other hand, if the affected passenger extraction program (237) determines that the read record is the last one (Yes in Step 1305), the program outputs, to the accident-affected passenger data, the information items stored in the memory which include: the accident ID, the card ID, the estimated date and time for the passenger to encounter the accident (Step 1306). In this process, the affected passenger extraction program (237) calculates an alternative route to a destination around the section of the accident such as ongoing transportation disturbance, and an estimated date and time by using: the boarding station/bus stop ID, the exit station/bus stop ID, the

boarding date and time, and the exit date and time acquired from the behavior pattern data (215); and the information items involved in the operation schedule such as the line master (420), the schedule master (430), and the route master (440). The program adds alternative route information such as the route ID, the boarding date and time, the exit date and time, the boarding station/bus stop ID, and the exit station/bus stop ID as shown in Fig. 9. In a case where the alternative route involves a plurality of lines, related information items are added to the same record as in the case of the behavior pattern table (215). The alternative route may be calculated by applying Dijkstra's algorithm to a railway/bus line network or by any other method. The affected passenger extraction program (237) stores the resultant accident-affected passenger data (218) in the data server (210).

[0060]

Fig. 15 is a flow chart showing the steps of an operation (congestion rate calculation processing) of calculating congestion rate from the movement log data and storing the resultant in a storage unit of the compute server. This processing is to estimate a congestion rate of a circumstance where there is no accident such as transportation disturbance and a congestion rate of a circumstance where the user moves via a normal route

without using the alternative route during the accident, by referring to the movement log data shown in Fig. 6. This processing can be performed at a time decided by the business operator as needed (e.g., at the time of accident or after accident).

[0061]

First, the congestion rate estimation program (235) retrieves the movement log data (Step 1400). As shown in Fig. 6, the movement log data includes the information items which include: the boarding stations/bus stops, the exit stations/bus stops, boarding dates and times, and exit dates and times corresponding to the number of the lines connected to travel from a departure point (boarding station/bus stop) to a destination (exit station/bus stop).

[0062]

Next, the congestion rate estimation program (235) generates divided movement log data pieces by dividing the movement log data into individual transfers (Step 1401). The congestion rate estimation program (235) sorts the divided movement log data records by the boarding date and time and queues them in line (Step 1402). The congestion rate estimation program 235 fetches a record of the earliest boarding date and time from the queue (Step 1403).

[0063]

The congestion rate estimation program (235)

identifies an available line by searching through the schedule master (430) based on the boarding station/bus stop and the boarding date and time as key (Step 1404). The congestion rate estimation program (235) selects from the available lines a line of a transportation system having the earliest departure time from the boarding date and time.

[0064]

The congestion rate estimation program (235) determines whether or not the number of passengers on the selected transportation system exceeds the riding capacity of the transportation system included in the line master (Step 1405). If it is determined that the number of passengers exceeds the riding capacity of the transportation system included in the line master (Yes in Step 1405), the program delays the boarding time by setting the boarding date and time in the divided movement log data piece to the next boarding time stored in the schedule master (430) and then queues the data piece in line (Step 1406).

[0065]

If it is determined that the passengers do not exceed the riding capacity of the transportation system included in the line master (No in Step 1405), the congestion rate estimation program (235) increases the number of

passengers on the transportation system by one (Step 1407).

[0066]

Subsequently, the congestion rate estimation program (235) determines whether or not the queue is empty (Step 1408). If it is determined that the queue is not empty (No in Step 1408), the program returns to Step 1403 and repeats the subsequent steps.

[0067]

On the other hand, if it is determined that the queue is empty (Yes in Step 1408), the congestion rate estimation program (235) divides the number of passengers by the riding capacity to give a congestion rate at each scheduled time and stores the result in the database (239) of the compute server (230) (Step 1409).

[0068]

Fig. 16 is a flow chart showing the steps of an operation (accident-time congestion rate calculation processing) of estimating a congestion rate at the time of accident and storing the result in the storage unit of the compute server. Similarly to the case of Fig. 14, the following description is made on assumption that an accident such as transportation disturbance occurred at a certain section of a transportation system before this processing and hence, the accident information data (216) was stored in the data server (210) by the business

operator.

[0069]

The congestion rate estimation program (235) retrieves the accident-affected passenger data (218), the movement log data, the accident-time behavior pattern data (217) and the accident information data (216) (Step 1500). The congestion rate estimation program (235) determines a circumvention rate by referring the accident-time behavior pattern data (217) and calculating a rate of passengers adopting a circumventing behavior equivalent to a behavior pattern ID of a behavior at the previous accident (Step 1501). For example, the congestion rate estimation program (235) calculates a rate of records which have the same card ID as that of previous records having an accident-time behavior pattern ID "1" or "2" in the accident-time behavior pattern data (217), and which are included in the accident-affected passenger data (218).

[0070]

The congestion rate estimation program (235) generates new movement log data by combining movement information pieces of the movement log data and the behavior pattern data. In this process, if the movement route and time slot are included in the accident section and time slot of the accident information data, the program calculates a route around the transportation

disturbance section and inputs a new movement log (Step 1502). The alternative route may be calculated by applying Dijkstra's algorithm to the railway/bus line network or by any other method. The new movement log includes information items including: lines, boarding points, exit points, boarding dates and times and exit dates and times that correspond to the number of transfers to travel from the departure point to the destination. Subsequently, the accident-time congestion rate is calculated by performing the same steps (Steps 1503 to 1511) as those shown in Fig. 15. In this manner, the accident-time congestion rate is determined and delivered to the user by means of screen display (Fig. 18, Fig. 19) to be described hereinlater, so as to support the user in utilizing a less congested transportation system while circumventing the disturbance. This also supports the railway business operator in obviating another accident caused by the congestion.

[0071]

Fig. 17 is a flow chart showing the steps of an operation (behavior pattern data generation processing) of determining an accident-time behavior pattern based on the movement and purchase log data and the information delivery data. Similarly to the case of Fig. 14, the following description is made on assumption that an accident such as transportation disturbance occurred at a

certain section of a transportation system before this processing and hence, the accident information data (216) was stored in the data server (210) by the business operator and subsequently, the accident came to an end.

[0072]

First, the accident-time behavior determination program (238) retrieves the movement and purchase log data (214) and the information delivery data (219) (Step 1600). The accident-time behavior determination program (238) extracts records of the movement and purchase log data (214), which have a card ID of the same value as that of the registrant ID of the information delivery data (219) (Step 1601).

[0073]

The accident-time behavior determination program (238) selects one registrant ID from the registrant IDs related to the delivered information, identifies some records that have the card ID of the same value as that of the registrant ID from the records of the extracted movement and purchase log data (214), and further identifies, from the identified records, a record that contains the same date and time as those recorded in the accident information data (216). The program compares the route of the identified record and the record of the information delivery data that contains the registrant ID

of interest. Referring to the accident-time behavior pattern table (218), the accident-time behavior determination program (238) determines which behavior pattern was adopted by the registrant at the time of the accident (Step 1603). If the movement log indicates the alternative route according to the delivered information, for example, the program sorts the record into a behavior pattern of circumventing according to the delivered information (accident-time behavior pattern ID "1"). If there is a purchase log indicating a purchase made near the station immediately after the delivery of accident information, the program sorts the record into a behavior pattern of making a purchasing activity (accident-time behavior pattern ID "4"). The other behavior patterns are sorted the same way. If the behavior patterns of all the registrants receiving the delivered information are not determined, the program returns to Step 1602. If the behavior patterns of all the registrants are determined, the respective behavior patterns of the registrants are outputted to the accident-time behavior pattern data (217), which is stored in the data server (Step 1605). At this time, if the behavior pattern of the registrant is already registered, the behavior pattern is updated and hence, the latest behavior pattern of the registrant is stored.

[0074]

Fig. 18 shows an example of a screen (1700) displaying an email delivering information (transportation disturbance information) to the registrants in the event of a transportation disturbance. The screen is composed of a title portion (1701) and a text portion (1711). The title portion (1701) carries a title of the mail. The title is previously defined by the system. The text portion (1711) carries information items: a line and section of accident such as transportation disturbance; accident time; accident cause and the like (accident information) (1702). The screen may also display a URL of a website providing a detailed explanation of the accident (detailed accident information 1703). Of these information items, the CPU (253) of the information delivery server (250) refers to the accident information data (216) and outputs the contents thereof as the accident information. As for the detailed accident information, the CPU outputs a URL to access the detailed accident information about the railway/bus line contained in the accident information (e.g., an operation restart time contained in the accident information data (216)).

[0075]

Further, the transportation disturbance information includes information about alternative route (1712) which is contained in the information delivery data (219). The

CPU (253) of the information delivery server (250) outputs the information about the alternative route in combination with the accident-time congestion rate (1707) of the respective transportation systems as determined in the processing of Fig. 16. According to Fig. 18, for example, the CPU (253) of the information delivery server (250) refers to the affected passenger data (218) shown in Fig. 9 so as to output the alternative route (route from Station A to Station B) of a certain user, and times (Station A: boarding date and time, Station C: exit date and time). The CPU also outputs the payment amount of 400 yen along with an estimated congestion rate of 20% at this time. While Fig. 18 shows the information about one alternative route, plural alternative routes are actually outputted as options.

[0076]

At this time, the CPU 253 of the information delivery server 250 may display a URL of a website (1708) for search purpose so as to permit the user to search the alternative route again. In response to a click of the above-described URL, for example, the CPU 253 of the information delivery server 250 activates the display screen generation program (256) so as to display a search screen for alternative route (2000) shown in Fig. 21 on a display portion of the portable terminal (282) of the user.

[0077]

Fig. 21 shows an example of a website screen for search of the alternative route. The search screen for alternative route (2000) includes input windows of a departure point (20001) and a destination (2002). In this connection, the display screen generation program (256) may search through the behavior pattern data (215) shown in Fig. 22 based on the registrant ID of the user as a key so as to previously input or display the boarding station/bus stop, and the exit station/bus stop contained in the record of the same card ID in vicinity of the input windows of the departure point and destination.

[0078]

The search screen for alternative route (2000) further includes a departure time input box (2003). When a search start button 2004 is pressed down, the search is started. A plurality of routes (2013, 2014) may be displayed as route search results with reference to the behavior pattern data (215) shown in Fig. 22. In this case, similarly to the case of Fig. 18, information about the departure time and arrival time (2005), fare (2006), the number of transfers (2007), the congestion rate (2007) and the like are displayed. A configuration may be made such that pressing a button (2013) displays specific routes included in the behavior pattern data (215) shown in Fig.

22.

[0079]

The display screen generation program (256) may also display additional information (1709) besides the alternative routes depending upon a behavior pattern estimated from the accident-time behavior pattern data (217) of the registrant. In a case where the accident-time behavior pattern table (218) contains a taxi usage history of the user, for example, the screen may display the URL and telephone number of a taxi company near the station. If the portable terminal (282) is equipped with a GPS function, the screen may display the URL and telephone number of the nearest taxi company.

[0080]

In the case of a behavior pattern of canceling the movement and returning to the departure point, the display screen generation program (256) may display a route from the present location or destination to the departure point in the same form as that of the alternative route. In a case where there is a history of purchasing near the station, the display screen generation program (256) may display shop information by accessing a HP of a company operating the shop of interest. The display screen generation program (256) may further display a URL (1710) which permits the user desiring to change the behavior

type thereof to click on to access the accident-time behavior pattern table shown in Fig. 5 and change the behavior type.

[0081]

Fig. 19 shows an example of a screen via which a business operator such as the railway business operator that administers the system decides the number of recipients of delivery information. Similarly to the case of the transportation disturbance information shown in Fig. 18, the display screen generation program (256) may display the transportation disturbance section (1801) and the transportation disturbance period (1802) on the screen by referring to the accident information data (216). The display screen generation program (256) may count card IDs per accident ID by referring to the affected passenger data (218) shown in Fig. 9 so as to display the number of affected persons or the number of affected passengers on the screen. Further, the program may count the number of users registered to the system (the number of registrants) out of the above affected passengers by referring to the registrant data (220) shown in Fig. 7 and display the count (1804) on the screen.

[0082]

In a case where the accident information data (216) and the values of the individual items displayed on the

screen are stored in the data server (210) in the form of history, the display screen generation program (256) may display a history of previous accidents having occurred on the same line and at the same time slot, the history including information items such as date and time of the previous accident (1806), the accident line (1807), the accident section (1808), and the number of delivery information recipients (1809) and the like. Further, the display screen generation program may be configured to automatically perform the same operation when a history 1805 of previous operations is selected. When displaying the operation history 1805, the display screen generation program (256) may calculate the congestion rate shown in Fig. 15 at the time of accident and at the end of the accident, so as to determine the effect on the congestion rate from the ratio between these values (how much the congestion was mitigated). The program may display on the screen the determination result (1810) along with the above-described information items. In this case, the effect is stored in conjunction with the above-described information items in the form of history.

[0083]

The screen may include a recipient number input box (1811) and a delivery time input box (1812), and a button (1815) for setting a delivery condition. The business

operator (272) can decide the number of recipients accordingly. In a case where the business operator provides an added value to the user who adopted the alternate route (for example, imparting some cashing points for movement or some cashing points for purchase), the business operator may set the value according to the operator's budget while the display screen generation program (256) may accept the set value. When setting the delivery condition, the business operator may compare the user's address stored in the registrant data (220) or the boarding station/bus stop or the exit station/bus stop fetched from the history stored in the movement and purchase log data (214) with map information (not shown) and then define a delivery area of the information delivery data (219) via another window.

[0084]

The display screen generation program (256) may set a condition such as a congestion rate reduction target and deliver the information to the registrants meeting the condition. For example, the display screen generation program (256) performs the accident-time congestion rate calculation processing shown in Fig. 16 by increasing the number of information recipients one by one in a manner to determine a congestion rate of a case where the number of information recipients is one (the number of persons

potentially circumventing the accident route by utilizing the system), to determine a congestion rate of a case where the number of information recipients is two, and so on, thus obtaining the congestion rates of the respective cases. When the total value of the congestion rates reaches a previously set target congestion rate (e.g., value of congestion rate decreased by 15%), the information delivery data (219) may be delivered to those registrants that was involved in the calculation (e.g., 1000 registrants out of 3000 registrants).

[0085]

In a case where the information delivery data (219) was delivered and the passenger used the alternative route, the display screen generation program (256) may display the estimated congestion rate (1813) indicating how much the congestion rate was decreased. For example, the display screen generation program (256) may refer to the accident-time behavior data (217) shown in Fig. 10 so as to count the number of records with the previous accident-time behavior pattern ID "1", out of the records of the same card ID as the card ID of the transportation network IC cards of the registrants contained in the information delivery data (219). Thus, the program determines the estimated congestion rate related to the present accident (congestion rate to be decreased) and displays the result

on the screen.

[0086]

When the condition such as the number of information recipients or the like is defined, the display screen generation program (256) delivers the information delivery data (219) in response to the pressing of a to-deliver button (1814). Alternatively, if the business operator determines that there is no need for information delivery, the display screen generation program (256) may not deliver the information delivery data (219) in response to the pressing of a not-to-deliver button (1815).

[0087]

Fig. 20 shows an example of a screen for the business operator administering the system, such as the railway business operator, to see the results of simulation of the transportation system or passenger flow. The figure shows: a simulation screen (1900) to see the flow of passengers; transportation disturbance information items (1901, 1902); the number of mail recipients (1903); utilization rate of alternative route (1904); and the number of passengers affected by transportation disturbance (1907). The transportation disturbance information items (1901, 1902) and the number of mail recipients (1903) are the same as the transportation disturbance section (1801) and the transportation disturbance period (1802) and the number of

mail recipients (1811) shown in Fig. 19. The display screen may also include an input box (1905) of the utilization rate of alternative route such as to view the passenger flow in the case of a change of the alternative route utilization rate.

[0088]

For example, if a rate of the users having taken the alternative route (e.g., the previous accident-time behavior pattern ID "1", "2") in the accident-time behavior data (217) shown in Fig. 10 is specified via the display screen, the display screen generation program (256) may randomly (or per route or per area) pick up the users from the accident-time behavior data (217) so as to display on the screen the movement of all the users that moved via the alternative route. Fig. 20 illustrates the alternative route extending downward to the right in contrast to the normal route extending upward to the right. The screen shows that an electric railcar or bus (1909) moves between stations/bus stops (1908). The display screen generation program 256 may display the simulation result in a manner that the alternative route on the screen is made thicker or changed in color with increase in the number of picked-up users. These screen displays can be controlled by means of an input interface such as a mouse and keyboard. For example, a wheel button may be

used to zoom in or zoom out. Further, the screen may be adapted to display the number of waiting passengers or riding passengers in response to click on the station, bus stop, electric railcar or bus.

[0089]

On the above-described screen, the display screen generation program (256) may display the breakdown of behavior types (1908) delivered as the delivery information. A chart showing the breakdown of the behavior types may be in the form other than the circle graph. When displaying the breakdown of behavior types (1907), for example, the display screen generation program (256) searches through the accident-time behavior data (217) shown in Fig. 10 based on the accident ID as a key so as to sort and compile the behavior patterns of the users at the time of the accident and to display the results on the screen.

[0090]

In this manner, the embodiment identifies the passenger affected by the transportation disturbance by performing the above-described operations for estimating the movement route and time slot specific to the user from the behavior history of the transportation network IC card data. Further, the embodiment mitigates the congestion on the alternative route by learning not only the information

of the alternative route but also the information of other than the circumventing behavior by the user, and delivering the information to the user. Using the movement and purchase log data generated from the transportation network IC card data, the embodiment performs respectively different operations before the transportation disturbance, during the transportation disturbance and after the operation restarted. Specifically, before the transportation disturbance, the embodiment estimates the behavior pattern of the passenger and registers the transportation network IC card data ID and mail address of the system user. During the transportation disturbance, the embodiment extracts the passenger affected by the transportation disturbance based on the accident information and the result of the previous estimation of the behavior pattern of the passenger. Further, the embodiment also delivers the information according to the instruction of the railway business operator. After the operation restarted, the embodiment analyzes the accident-time behavior of the passenger receiving the information during the transportation disturbance and updates the accident-time behavior pattern. Thus, the embodiment can save the user time and trouble by analyzing the behavior pattern of the user from the transportation network IC card data and automatically updating the movement route

information of the user registered to the system. Further, the embodiment can reduce the people crowding toward the alternative route and achieve the congestion mitigation by analyzing the actual behavior of the user and adding the information for decentralizing the passengers such as information about shops near the station and the URLs of taxi companies.

[0091]

It is noted that the invention is not limited to the above-described embodiment and includes a variety of modifications. For example, the above embodiment is a specific description of the invention for clarity but the invention is not necessarily limited to what includes all the elements described. A part of the structure of one embodiment can be replaced with a structure of another embodiment. Further, a structure of one embodiment can be added with a structure of another embodiment. The structure of each embodiment partially permits deletion, and addition of or replacement with a structure of another embodiment.

Reference Signs List

[0092]

100: Transportation network IC card data

101: Processing of generating movement and purchase log

data

120: Before-Accident processing

121: Processing of estimating behavior pattern

122: Processing of estimating congestion rate

123: Card ID and mail address information of user

124: Processing of generating registrant data

125: Accident-time behavior list

130: Processing during accident

131: Accident information by business operator

132: Processing of extracting passenger affected by transportation disturbance

133: Information delivery instruction by business operator

134: Information delivery processing

140: Post-accident processing

141: Processing of estimating post-accident behavior

142: Processing of updating accident-time behavior list

200: User of transportation network IC card

201: Transportation network IC card

202: Ticket gate

203: Bus

204: Portable terminal

205: User

206: TAXI

207: Network

208: System For extracting and guiding passenger affected

by transportation disturbance for mitigating congestion during transportation disturbance

210: Data Server

211: Storage Unit

212: Transportation network IC card data

213: Master data

214: Movement and purchase log data

215: Behavior pattern data

216: Accident information data

217: Accident-time behavior data

218: Accident-time behavior pattern table

219: Information delivery data

220: Registrant data

230: Compute server

231: Interface

232: CPU

233: Memory

234: Movement and purchase log generation program

235: Congestion rate estimation program

236: Behavior pattern extraction program

237: Affected passenger extraction program

238: Accident-time behavior determination program

239: Storage unit

240: Data storage unit

241: Affected passenger data

250: Information delivery server

251: Interface

252: STORAGE unit

253: CPU

254: Memory

255: Simulation program

256: Display screen generation program

257: Query acquisition program

258: Interface

270: Network

271: Operation terminal

272: Business operator

273: Network

281: User of the system

282: Portable terminal

# CLAIMS

1. A passenger guidance system for guiding a passenger moving via a route using an IC card, comprising:

a behavior pattern extraction section that by referring to movement log data recording a movement history of the user which includes usage date and time of a transportation system and a route, outputs a behavior pattern of the user;

a passenger extraction section that by referring to the usage date and time and the route included in the behavior pattern, and accident information data including an accident section, an accident time and an operation restart time, extracts a user, out of the users, as an accident-affected user whose route includes the accident section and whose usage date and time includes the accident time, and then determines an alternative route for the user based on the route of the extracted user and master operation information of the transportation system;

an information delivery section that transmits to a terminal of the extracted user information delivery data including the alternative route; and

a behavior determination section that by referring to the movement log data and the alternative route, determines whether or not the user receiving the

information delivery data moved via the alternative route at the time of accident, and records the determination result in accident-time behavior pattern data.

2. The passenger guidance system according to Claim 1, further comprising a congestion rate calculation section that determines a congestion rate of a transportation system based on the alternative route of the user and the master operation information when the user took a detour, wherein

the information delivery section transmits the information delivery data including the congestion rate.

3. The passenger guidance system according to Claim 2, wherein

the congestion rate calculation section refers to the behavior pattern and the master operation information, and calculates the congestion rate of the transportation system when an accident has occurred and the user moved via the route according to the behavior pattern, and

the passenger guidance system further comprises a screen display section that compares the calculated congestion rate and a congestion rate when the user took a detour, and displays the comparison result on a display portion of a monitor terminal possessed by a business

operator of the transportation system.

4. The passenger guidance system according to Claim 3, wherein

the behavior pattern extraction section outputs a behavior pattern of when the user made a purchase based on purchase log data recording the history of transaction when the user purchased some goods or used some service by way of an IC card,

the screen display section refers to the movement log data, purchase master data indicating the purchasing place, and the accident information data, sorts the behavior pattern in the event of an accident at the transportation system into a behavior pattern of using the alternative route, a behavior pattern of making a purchase, a behavior pattern of using a transportation system other than that on the alternative route or a behavior pattern belonging to none of the above, and displays sorting results at the display portion.

5. A passenger guidance method for guiding a passenger moving via a route using an IC card, comprising:

a behavior pattern extraction step of outputting a behavior pattern of the user based on movement log data recording a movement history of the user which includes

usage date and time of a transportation system and the route;

a passenger extraction step of referring to usage date and time, and the route included in the behavior pattern, and accident information data including an accident section, an accident time and an operation restart time, and extracting a user out of the users as an accident-affected user whose route includes the accident section and whose usage date and time includes the accident time;

an alternative route calculation step of referring to the route of the extracted user and master operation information of the transportation system, and determining an alternative route for the user;

an information delivery step of transmitting information delivery data including the alternative route to a terminal of the extracted user;

a determination step of referring to the movement log data and the alternative route, and determining whether or not a user receiving the information delivery data moved via the alternative route after accident; and

a recording step of recording the determination result in accident-time behavior pattern data.

6. The passenger guidance method according to Claim 5, further comprising a congestion rate calculation step of referring to the alternative route of the user and the master operation information, and determining a congestion rate of the transportation system when the user took a detour, wherein

the information delivery data including the congestion rate is transmitted in the delivery step.

7. The passenger guidance method according to Claim 6, wherein

the congestion rate calculation step refers to the behavior pattern and the master operation information, and calculates the congestion rate of the transportation system in a case where an accident has occurred and passengers moved via the route of the behavior pattern, and

the passenger guidance method further comprises a screen display step of comparing the calculated congestion rate and the congestion rate of when the user took a detour, and displaying the comparison result at a display portion of a monitor terminal possessed by a business operator of the transportation system.

8. The passenger guidance method according to Claim 7,

wherein

the behavior extraction step refers to the purchase log data recording the history of transaction when the user purchased some goods or used some service by way of an IC card, and outputs a behavior pattern of when the user made a purchase, and

the screen display step refers to the movement log data, purchase master data indicating the purchasing place, and the accident information data, sorts the behavior pattern in the event of an accident at the transportation system into a behavior pattern of using the alternative route, a behavior pattern of making a purchase, a behavior pattern of using a transportation system other than that on the alternative route, or a behavior pattern belonging to none of the above, and displays the sorting result at the display portion.