DESCRIPTION

ANALYSIS SYSTEM

Field

[0001] The present invention relates to an analysis system.

Background

[0002] As a conventional analysis system, for example, Patent Literature 1 discloses an aggregating device. This aggregating device is configured to detect, on the basis of image data captured by first to third image capturing devices, how many pedestrians are present in the vicinity of a shop, how many people have entered the shop, and how many people have purchased a good/goods inside the shop, and aggregate, per a predetermined time unit, the numbers of the pedestrians/people thus respectively detected.

Citation List

Patent Literature

[0003] Patent Literature 1: JP 2007-011723 A

Summary

Technical Problem

[0004] The analysis system as described above still has a room for further improvement, for example, in terms of analysis accuracy.

[0005] The present invention has been made in view of the aforementioned circumstances, and an object of the present invention is to provide an analysis system capable of facilitating the improvement of analysis accuracy.

Solution to Problem

[0006] To achieve the above object, an analysis system according to the present invention includes a moving object analysis data collecting device mounted on a moving object and configured to collect first analysis material data including first image data indicative of an image of an

external view viewed from the moving object, the image being captured during traveling of the moving object, and first positional data indicative of a location at which the capturing of the image of the external view viewed from the moving object was carried out; and a data analysis device configured to analyze, on a basis of the first analysis material data thus collected by the moving object analysis data collecting device, an attribute of a person included in the image indicated by the first image data, and a flow of people whose attributes have been thus determined.

[0007] In the analysis system, the data analysis device may be configured to extract an image including a feature point of the person from among a plurality of the images of the first image data, the feature point being such that an attribute of the person can be determined from the feature point, and to analyze, on a basis of the image thus extracted, the attribute of the person included in the image.

[0008] In the analysis system, the moving object analysis data collecting device may be further configured to collect second analysis material data including second image data indicative of an image of an internal view of the moving object, and second positional data indicative of a location at which the capturing of the image of the internal view of the moving object was carried out, and the data analysis device may be further configured to analyze, on a basis of the second analysis material data thus collected by the moving object analysis data collecting device, an attribute of a person included in the image indicated by the second image data, and a flow of people whose attributes have been determined.

[0009] The analysis system may include a fixed-position object analysis data collecting device mounted on a fixed-

position object provided on a road, and configured to collect third analysis material data including third image data indicative of an image of an external view viewed from the fixed-position object, the image being captured by the fixed-position object analysis data collecting device as mounted on the fixed-position object, and third positional data indicative of a location at which the capturing of the image of the external view viewed from the fixed-position object was carried out, wherein the data analysis device may be further configured to analyze, on a basis of the third analysis material data thus collected by the fixed-position object analysis data collecting device, an attribute of a person included in the image indicated by the third image data, and a flow of people whose attributes have been determined.

[0010] In the analysis system, the moving object may be a moving object that drives in a predetermined route repeatedly.

[0011] In the analysis system, the data analysis device may include a storage section configured to accumulate analysis result data indicative of an analysis result analyzed by the data analysis device.

[0012] In the analysis system, the attribute of the person to be analyzed by the data analysis device may include his/her gender, age, physique, social status, favoring, or behavioral tendency.

Advantageous Effects of Invention

[0013] An analysis system according to the present invention is capable of analyzing using a data analysis device, on the basis of first analysis material data, an attribute of a person included in an image indicated by first image data, and a flow of people whose attributes have been determined. In this case, the analysis system is

capable of collecting, during traveling of a moving object, first image data and first positional data by a moving object analysis data collecting device mounted on the moving object, the first image data and the first positional data constituting the first analysis material data. As a result, the analysis system can bring about such an advantageous effect as to ensure collection of a relatively large amount of the first analysis material data available for analysis to be conducted by a data analysis device, thereby making it possible to facilitate the improvement of the analysis accuracy.

Brief Description of Drawings

[0014] FIG. 1 is a block diagram schematically illustrating a configuration of an analysis system according to a first embodiment.

FIG. 2 is a schematic diagram illustrating one example of analysis result data obtained as a result of analysis and processes performed by the analysis system according to the first embodiment.

FIG. 3 is a flow chart illustrating one example of a process performed by the analysis system according to the first embodiment.

FIG. 4 is a block diagram schematically illustrating a configuration of an analysis system according to a second embodiment.

FIG. 5 is a block diagram schematically illustrating a configuration of an analysis system according to a third embodiment.

Description of Embodiments

[0015] In the following, embodiments according to the present invention will be described in more detail on the basis of the drawings. It should be noted that these embodiments are not to limit the present invention.

Moreover, constituent elements described in the embodiments below encompass those that can substitute these constituent elements or can be easily arrived at from these constituent elements by a person skilled in the art, and those equivalent to these constituent elements.

[0016] [First Embodiment]

An analysis system 1 according to a present embodiment as illustrated in FIG. 1 includes a recording device 10 serving as a moving object analysis data collecting device, and an analysis device 20 serving as a data analysis device, and is configured to provide a client terminal CL with analysis result data obtained by analysis performed by the analysis device 20. The analysis device 20 of the present embodiment is configured to analyze, on the basis of images collected by the recording device 10, an attribute of a person and a flow of people whose attributes have been determined. In this case, the analysis system 1 is configured to facilitate the improvement of analysis accuracy by employing the recording device 10 mounted on a moving object V, as a device for collecting analysis material data that is to be used for the analysis performed by the analysis device 20. In the following, a configuration of the analysis system 1 will be described, referring to the drawings.

[0017] The recording device 10 is configured to collect the first analysis material data that is to be used for the analysis performed by the analysis device 20. The first analysis material data is data including first image data indicative of an image, and first positional data indicative of a position at which capturing of the image was performed. The recording device 10 of the present embodiment is configured to be mounted on the moving object V. Typically, the moving object V for mounting the

recording device 10 may be a vehicle for driving on a road, which may be any one of an owner-driver vehicle, a rent car, a sharing car, a ride-share car, a bus, a taxi, a truck, a transport vehicle, a service car, or the like, for example. In a typical configuration, a plurality of the moving objects V is provided, each of which is provided with the recording device 10. That is, the analysis system 1 of the present embodiment may be configured to include a plurality of recording devices 10 respectively mounted on a plurality of moving objects V, thereby being capable of collecting analysis material data from the plurality of the recording devices 10. It is preferable that at least part of the plurality of recording devices 10 be mounted on vehicles driving in a predetermined route repeatedly such as local buses and long-distance transport trucks. The recording device 10 is configured to collect, as the first analysis material data, the first image data indicative of an image of an external view viewed from the moving object V, the image being captured during traveling of the moving object V, and the first positional data indicative of a position at which the capturing of the image of the external view from the moving object V was performed. The recording device 10 may use an in-vehicle device, such as a so-called drive recorder, mounted on the moving object V, but the recording device 10 is not limited to such a configuration.

[0018] More specifically, the recording device 10 includes an external view camera 11, a positional information measuring unit 12, a data input/output section 13, and a control section 14.

[0019] The external view camera 11 is an external view image capturing device for capturing an image of an external view viewed from the moving object V. The external view camera 11 is configured to capture the image

of the external view viewed from the moving object V during the traveling of the moving object V and collect the first image data indicative of the image of the external view viewed from the moving object V. Typically, the external view camera 11 is configured to capture a moving image of the external view viewed from the moving object V. The externa view camera 11 is mounted on the moving object V in such a way that the external view camera 11 is set with such an angle of view that allows the externa view camera 11 to capture a person to be analyzed by the analysis system 1, which is a person on a road viewed from the moving object V in this embodiment. It may be so configured that a plurality of the external view cameras 11 is provided on the moving object V so as to be positioned respectively at multiple positions of the moving object V such as a front portion, a side portion, a rear portion, and a roof portion, so that the capturing of an image of a person on a road from the moving object V can be performed more appropriately. The external view camera 11 may be a monocular camera and may be a stereo camera. Moreover, the image to be captured by the external view camera 11 may be a black-and-white image or a color image. The external view camera 11 is communicably connected with the control section 14, and is configured to output to the control section 14 the first image data thus collected.

[0020] The positional information measuring unit 12 is a measuring unit for measuring to locate a current position of the moving object V. For example, the positional information measuring unit 12 may be a global positioning system (GPS) receiver unit for receiving radio waves transmitted from GPS satellites, or the like unit. For collecting the first positional data indicative of the position at which the capturing of the image of the

external view viewed from the moving object V was performed, the positional information measuring unit 12 is configured to obtain GPS information (latitude and longitude coordinates) as information indicative of the current position of the moving object V by receiving the radio waves transmitted from the GPS satellites. The positional information measuring unit 12 is communicably connected with the control section 14 and is configured to output to the control section 14 the first positional data thus collected.

[0021] The data input/output section 13 is configured to perform input/output of various data between the recording device 10 and a device other than that recording device 10. The data input/output section 13 of the present embodiment is capable of outputting the first analysis material data to the analysis device 20, which is a device other than that recording device 10. The data input/output section 13 may be, for example, configured to input/output the data to/from a device other than that recording device 10 by communication via a network (regardless of whether the communication is wired or wireless). Moreover, the data input/output section 13 may be, for example, configured to include a slot section and to input/output the data to/from a device other than that recording device 10 via a recording medium inserted in the slot section. Here, the recording medium may be, for example, a memory (removable medium) that can be detachably attached with the recording device 10 via the slot section. The recording medium may be, for example, memory cards of various types, such as an SD card, but is not limited to these.

[0022] The control section 14 is configured to control components of the recording device 10 administratively. The control section 14 is configured to perform various

computing processes for collecting the first analysis material data. The control section 14 includes an electronic circuit mainly constituted with a well-known micro computer including a central processing device such as a central processing unit (CPU), a read only memory (ROM), a random-access memory (RAM), and an interface. The control section 14 is communicably connected with the components such as the external view camera 11, the positional information measuring unit 12, and the data input/output section 13, thereby being capable of transmitting and receiving various signals and data to/from the components.

[0023] More specifically, the control section 14 includes a storage section 14A and a processing section 14B. The storage section 14A and the processing section 14B are capable of transmitting and receiving various signals and data to/from the components mutually. The storage section 14A is configured to store conditions and information necessary for various processes that the processing section 14B performs, various programs and applications that the control section 14 executes, control data, and the like. The storage section 14A may be configured to store the first analysis material data together with a time at which the first analysis material data was collected or the like information. In other words, the first analysis material data also includes time data indicative of the time at which the first analysis material data was collected, and the other data. For example, the storage section 14A may be configured to temporally store various data generated in the course of the processes performed by the processing section 14B. The storage section 14A is such that the processing section 14B, the data input/output section 13, or the like retrieves data from the storage section 14A as

needed. The storage section 14A may be, for example, a storage device with a relatively large capacity such as a hard disk, a solid-state drive (SSD), or an optical disk, or a data-rewritable semiconductor memory such as a RAM, a flash memory, or a non-volatile static random-access memory (NVSRAM). The processing section 14B is configured to run, according to various input signals or the like, various programs stored in the storage section 14A, and perform various processes for carrying out various functions by running the programs and thereby outputting output signals to the components. The processing section 14B is configured to control operations of the external view camera 11 and the positional information measuring unit 12, so as to carry out the process for collecting the first analysis material data including the first image data and the first positional data. Moreover, the processing section 14B is configured to carry out the process regarding the input and output of the data, which are to be carried out via the data input/output section 13. The processing section 14B may be, for example, configured to carry out a process for outputting the first analysis material data to the analysis device 20 via the data input/output section 13.

[0024] The analysis device 20 is configured to analyze the first analysis material data thus collected by the recording device 10, and provide a client terminal CL with analysis result data indicative of an analysis result of the analysis. The analysis device 20 and the client terminal CL may constitute a so-called cloud service-type device implemented on a network (that is, a cloud server), or may be stand-alone type devices independent from a network. The analysis device 20 is configured to analyze, on the basis of the first analysis material data thus

collected by the recording device 10, an attribute of a person included in the image indicated by the first image data included in the first analysis material data, and a flow of people whose attributes have been determined. The analysis device 20 according to the present embodiment is configured to generate personal attribute data indicative of the attribute of the person, and attribute-based categorized people's flow data, which is indicative of the flow of people whose attributes have been determined. After that, the analysis device 20 provides the client terminal CL with analysis result data including the personal attribute data and the attribute-based categorized people's flow data.

[0025] The analysis device 20 is configured to perform various computing processes for analyzing, on the basis of the first analysis material data, the attributes of people, and the flow of the people. The analysis device 20 includes an electronic circuit mainly constituted with a well-known microcomputer including a central processing device such as a CPU, a ROM, a RAM, and an interface. The analysis device 20 may be constituted by installing, on a computer system such as a known personal computer or work station, applications for carrying out various processes described below.

[0026] More specifically, the analysis device 20 includes a data input/output section 21, a storage section 22, and a processing section 23. The data input/output section 21, the storage section 22, and the processing section 23 are capable of transmitting and receiving various signals and data to/from each other.

[0027] The data input/output section 21 is configured to perform input/output of various data between the analysis device 20 and a device other than that analysis device 20.

The data input/output section 21 according to the present embodiment is capable of receiving the first analysis material data from the recording device 10, which is a device other than the analysis device 20. Furthermore, the data input/output section 21 according to the present embodiment is capable of outputting the analysis result data to the client terminal CL, which is a device other than the analysis device 20. The data input/output section 21 may be, similarly to the data input/output section 13, for example, configured to transmit/receive the data to/from a device other than the analysis device 20 by communication via a network (regardless of whether the communication is wired or wireless). Similarly, the data input/output section 21 may be, for example, configured to include a slot section and to send/receive the data to/from a device other than the analysis device 20 via a recording medium inserted in that slot section.

[0028] The storage section 22 is configured to store conditions and information necessary for various processes performed by the processing section 23, various programs and applications that the processing section 23 executes, and control data and the like. The storage section 22 is capable of storing the first analysis material data received via the data input/output section 21. The storage section 22 may be, for example, configured to temporally store various data generated in the course of the processes performed by the processing section 23. The storage section 22 is such that the data input/output section 21, the processing section 23, and the like retrieve data from the storage section 22 as needed. The storage section 22 may be, for example, a storage device with a relatively large capacity such as a hard disk, an SSD, or an optical disk, or a data-rewritable semiconductor memory such as a

RAM, a flash memory, or a NVSRAM.

[0029] More specifically, the storage section 22 is configured to include, in terms of functional concept, an analysis target database (hereinafter, abbreviated as analysis target DB) 22A, an analysis reference database (hereinafter, abbreviated as analysis reference DB) 22B, and an analysis result database (hereinafter, abbreviated as analysis result DB) 22C.

[0030] The analysis target DB 22A is a section for accumulating the first analysis material data, which is analysis target data to be analyzed by the processing section 23 (such as the first image data, the first positional data, and the time data), and storing, as a database, the first analysis material data thus accumulated. The first analysis material data inputted into the data input/output section 21 from the recording device 10 is stored into the analysis target DB 22A.

[0031] The analysis reference DB 22B is a section for accumulating analysis reference data, which is referred to for the analysis of the first analysis material data performed by the processing section 23, and storing, as a database, the analysis reference data thus accumulated. The analysis reference data may include, for example, map reference data, attribute estimation reference data, and the like. The map reference data is data indicative of a map, which is referred to in determining, on the basis of the first positional data or the like, the position of the moving object V, that is, the position at which the capturing of the external view viewed for the moving object V was performed. The attribute estimation reference data is data, which is referred to in performing estimation or the like regarding the attribute of the person included in the image indicated by the first image data or the like.

The attribute estimation reference data will be described below in more detail. The analysis reference data is referred to by the processing section 23 in analyzing the first analysis material data.

[0032] The analysis result DB 22C is a section for accumulating analysis result data indicative of an analysis result of the analysis of the first analysis material data performed by the processing section 23, and storing, as a database, the analysis result data thus accumulated. The analysis result data may include, for example, personal attribute data indicative of the attributes of people included in the image indicated by the first image data, the attribute-based categorized people's flow data, which is indicative of the flows of people whose attributes have been determined, and the like. The analysis result data is processed into a desired format by the processing section 23, and outputted and provided from the data input/output section 21 to the client terminal CL.

[0033] Further, the various data stored in the analysis target DB 22A, the analysis reference DB 22B, and the analysis result DB 22C can be utilized as so-called big data.

[0034] The processing section 23 is configured to execute, according to various input signals or the like, various programs stored in the storage section 22 and thereby execute various processes for the analysis of the first analysis material data via the operations of the programs. Moreover, the processing section 23 is configured to carry out a process for processing the analysis result data into the desired format. Furthermore, the processing section 23 is configured to carry out a process for transmitting and receiving the data via the data input/output section 21. The processing section 23

may be, for example, configured to execute a process for outputting, to the client terminal CL via the data input/output section 21, the analysis result data thus processed into the desired format.

[0035] More specifically, the processing section 23 is configured to include, in terms of functional concept, a data preprocessing section 23A, a data analysis processing section 23B, and a data processing section 23C.

[0036] The data preprocessing section 23A is a section for performing various preprocesses to the first analysis material data, which is the analysis target data. For example, the data preprocessing section 23A may be configured to carry out, as a preprocess, a process for retrieving the first analysis material data, which is the analysis target data, from the analysis target DB 22A, and cut out a still image from the moving image of the first image data included in the first analysis material data. Moreover, for example, the data preprocessing section 23A may be configured to carry out, as a preprocess, a process for associating the cut-out still image with the position indicated by the first positional data included in the first analysis material data, which is the analysis target data. Further, the data preprocessing section 23A may be configured to carry out, as a preprocess, detection and extraction of a person from the cut-out still image by using various well-known image processing techniques. Moreover, the data preprocessing section 23A may be configured to carry out a process for extracting an image including a feature point of the person from among a plurality of images of the first image data. Here, the feature point of the person is a site of the person included in the image, the site being so distinguishable that an attribute of the person can be determined from the

site. The feature point of the person may be, for example, his/her face on which a facial expression of the person would be expressed, his/her hand or leg on which a behavior or gesture of the person would be expressed, a location on which an accessory or the like would be likely worn, or the like site. Because the first image data according to the present embodiment is collected by the recording device 10 mounted on the moving object V during the traveling of the moving object V, the first image data would highly possibly include a large number of images of the same person captured at different angles. By utilizing this feature, the data preprocessing section 23A extracts, from among the large number of images captured at different angles during the traveling of the moving object V, images on which the feature point of the person usable for determining the attribute of the person is captured, thereby optimizing the quantity of the data available for determining the attribute of the person.

[0037] The data analysis processing section 23B is a section for analyzing, on the basis of the first analysis material data thus preprocessed by the data preprocessing section 23A, the attribute of the person included in the image indicated by the first image data, and the flow of people whose attributes have been determined. Here, the data analysis processing section 23B may be configured to be capable of executing, for example by various well-known artificial intelligence techniques or deep learning techniques, a process for analyzing the attribute of the person included in the image indicated by the first image data, and the flow of people whose attributes have been determined.

[0038] The data analysis processing section 23B according to the present embodiment is configured to

analyze, on the basis of an image including the feature point of the person extracted from the first image data by the data preprocessing section 23A, the attribute of the person included in the image. The data analysis processing section 23B may be configured to analyze the attribute of the person on the basis of, for example, the attribute estimation reference data (analysis reference data) stored in the analysis reference DB 22B and the feature point of the person included in the image extracted from the first image data by the data preprocessing section 23A. Here, the attribute estimation reference data is information to which a result of learning of attributes of people that, by various techniques using the artificial intelligence techniques or deep learning techniques, can be estimated from the feature points or the like of a person included in an image have been reflected. In other words, the attribute estimation reference data is a data databased by various techniques using the artificial intelligence techniques or deep learning techniques in order to carry out the estimation of the attribute of the person on the basis of the feature point or the like of the person included in the image. The attribute estimation reference data can be updatable from time to time. For example, the learning of the attribute estimation reference data may be based on the analysis result data (personal attribute data) indicative of the analysis result obtained by the data analysis processing section 23B.

[0039] The attribute of the person to be analyzed by the data analysis processing section 23B may be, typically, matters that can be analyzed from feature points of an outer appearance of the person, including, for example, his/her gender, age, physique, social status, favoring, behavioral tendency, or the like matter of the person.

Here, the gender is an attribute indicative of whether the person is male or female. The age is an attribute indicative of a length of time in which the person has lived from his/her birth to the current time (at the time). The physique is an attribute indicative of a height, a weight, and various sizes. The social status is an attribute indicative of jobs (self-employed, business person, police, student, unemployed, part-timer), annual income, social standing, companion, or the like. The favoring is an attribute indicative of tendency of clothes, belongings, or fashion (such as casual type, elegant type, brand consciousness type, luxury type, and fast-fashion type), hobbies (such as sports, subculture, outdoor, and beauty treatment), or the like. The behavioral tendency is an attribute indicative of his/her feelings at the time, interests or concerns (such as something the person wants to do, and somewhere the person wants to go), or the like. That is, in this embodiment, the data analysis processing section 23B estimates, as an attribute of the person, the gender, age, physique, social status, favoring, behavioral tendency, or the like.

[0040] The data analysis processing section 23B is configured to extract, with reference to the attribute estimation reference data, the attribute (such as gender, age, physique, social status, favoring, or behavioral tendency) corresponding to the feature point of the person included in the image, and estimate that the attribute thus extracted is the attribute of the person included in the image. For example, the data analysis processing section 23B may be configured to estimate the attribute of the person such as the gender, age, physique, social status, favoring, behavioral tendency, or the like by referring to the attribute estimation reference data according to the

feature point of the person included in the image such as his/her facial expression, the behavior of his/her hand or leg, the accessory or clothes that he/she was wearing, or the like, and perform matching to determine an attribute matched with the feature point.

[0041] Furthermore, the data analysis processing section 23B is configured to carry out a process for analyzing, on the basis of the positional data associated with the image data for which the attribute of the person has been determined, the flow of people whose attributes have been determined as described above. The data analysis processing section 23B may be, for example, configured to retrieve, from the analysis target DB 22A, the first positional data associated with the first image data in which the attribute of the person has been determined. After that, the data analysis processing section 23B may be configured to analyze, on the basis of the map reference data (analysis reference data) stored in the analysis reference DB 22B and the first positional data thus retrieved, the flow of people whose attributes have been determined. For example, the data analysis processing section 23B may be configured to determine the positions at which the capturing of the images was performed, on the basis of the first positional data with reference to the map reference data. Then, the data analysis processing section 23B may be configured to determine positions of the people whose attributes have been determined, on the basis of the positions indicated by the first positional data, and determine the flow of people by putting the positions of the people in time sequential order. The flow of people analyzed by the data analysis processing section 23B may be indicated, typically, by distributions of the people in time frames, traveling directions and traveling speeds of

the people, start and end points of the traveling of the people, or the like. That is, in this embodiment, the data analysis processing section 23B is configured to estimate, as the flow of people whose attributes have been determined, the distributions of the people in the time frames, the traveling directions and traveling speeds of the people, the start and end points of the traveling of the people, or the like

[0042] The data analysis processing section 23B is configured to generate, as the analysis result data obtained as an analysis result of the analysis of the first analysis material data, the personal attribute data indicative of the attribute of the person thus analyzed, and the attribute-based categorized people's flow data indicative of the flow of people whose attributes have been determined. After that, the data analysis processing section 23B causes the analysis result DB 22C to accumulate and store, as a database, the analysis result data including the personal attribute data and the attribute-based categorized people's flow data thus generated.

[0043] The data processing section 23C is a section for carrying out a process for processing into the desired format the analysis result data thus obtained by the analysis of the data analysis processing section 23B. The data processing section 23C is configured to process, into the desired format, the personal attribute data and the attribute-based categorized people's flow data included in the analysis result data. The data processing section 23C may be configured to process the analysis result data including the personal attribute data and the attribute-based categorized people's flow data, for example, into information on which information regarding how many people with which attribute were present where and when or the

like information is plotted on a map, various graphs, diagrams, or the like as illustrated in FIG. 2 as examples. After that, the processing section 23 carries out a process for outputting, to the client terminal CL via the data input/output section 21, the analysis result data thus processed into the desired format by the data processing section 23C. The client terminal CL is a terminal capable of utilizing the analysis result data thus provided by the analysis device 20, for various purposes such as trade area survey, marketing, advertising, disaster prevention planning, urban planning, etc., for example. The client terminal CL may be, for example, a notebook personal computer (PC), a disk-top PC, a tablet PC, a smartphone, a mobile phone, or the like.

[0044] Next, one example of the processes in the analysis system 1 will be described, referring to a flow chart in FIG. 3.

[0045] To begin with, the recording device 10 collects the first analysis material data including the first image data and the first positional data, during the traveling of the moving object V (Step S1).

[0046] Next, the recording device 10 outputs, via the data input/output section 13, the first analysis material data thus collected, so as to input the first analysis material data to the analysis device 20 via the data input/output section 21 of the analysis device 20 (Step S2). The first analysis material data thus inputted into the analysis device 20 is stored into the analysis target DB 22A.

[0047] Next, the data preprocessing section 23A of the analysis device 20 carries out various preprocesses as described above to the first analysis material data stored in the analysis target DB 22A (Step S3).

[0048] Next, the data analysis processing section 23B of the analysis device 20 analyzes, on the basis of the first analysis material data thus preprocessed by the data preprocessing section 23A, an attribute of a person included in an image indicated by the first image data and a flow of people whose attributes have been determined (Step S4).

[0049] After that, the data analysis processing section 23B generates the personal attribute data and the attribute-based categorized people's flow data as the analysis result data, and accumulates and stores, as database, the generated data in the analysis result DB 22C (Step S5).

[0050] Next, the data processing section 23C of the analysis device 20 processes, in response to a request from the client terminal CL or the like, the analysis result data (the personal attribute data and the attribute-based categorized people's flow data) stored in the analysis result DB 22C into a desired format as illustrated in FIG. 2 as examples (Step S6).

[0051] After that, the processing section 23 of the analysis device 20 outputs and provides, to the client terminal CL via the data input/output section 21, the analysis result data thus processed into the desired format by the data processing section 23C (Step S7), and ends the series of processes.

[0052] The analysis system 1 described above is capable of analyzing, by the analysis device 20 and on the basis of the first analysis material data, an attribute of a person included in an image indicated by the first image data, and the flow of people whose attributes have been determined. In this case, the analysis system 1 is capable of collecting the first image data and the first positional

data constituting the first analysis material data by the recording device 10 mounted on the moving object V during traveling of the moving object V. With this configuration, this analysis system 1 can cause the recording device 10 to collect the first analysis material data while the recording device 10 is traveling along the road on the moving object V, thereby making it possible to ensure collection of a dramatically greater amount of the first analysis material data than, for example, a case where the first analysis material data is collected by a data collecting device fixedly provided on the road. Moreover, this analysis system 1 can collect a large amount of the first image data indicative of images of a same person captured at different angles, because the first image data is collected by the recording device 10 during the traveling of the moving object V. As a result of this, the analysis system 1 can ensure collection of a relatively large amount of the first analysis material data available for the analysis of the analysis device 20, thereby making it possible to facilitate the improvement of the analysis accuracy.

[0053] Moreover, the analysis system 1 can collect first analysis material data from people actually existing in an area targeted by the data collection, so that the first analysis material data can be more random and less biased in terms of attributes than a case where analysis material data is collected by using a particular application, self-administered questionnaires, materials summarized by particular persons, or the like. Again in this regard, this analysis system 1 can facilitate the improvement of the analysis accuracy. Moreover, the analysis system 1 can collect the first analysis material data with relatively greater anonymity than, for example, a case where analysis

material data is collected directly from mobile terminals or the like belonging to individual persons. Because of this, the analysis system 1 can obtain analysis result data with relatively greater anonymity in favor of personal information protection.

[0054] The analysis system 1 described above can optimize the quantity of the data available for determining the attribute of the person by extracting images including a feature point of the person usable for the determination of the attribute of the person from among a large number of images captured from different angles by the recording device 10 during the traveling of the moving object V. As a result, this analysis system 1 can further facilitate the improvement of the analysis accuracy.

[0055] Moreover, it is preferable that the analysis system 1 described above includes, as the moving objects V provided with the recording device 10, a moving object V that drives in a predetermined route repeatedly. In this case, the analysis system 1 can effectively collect a large amount of the first analysis material data in different time frames in a same area by the recording device 10 mounted on the moving object V driving in the predetermined route repeatedly. Therefore, again in this regard, the analysis system 1 can facilitate the improvement of the analysis accuracy.

[0056] Moreover, because the analysis system 1 described above includes the storage section 22 for accumulating the analysis result data (analysis result DB 22C), the analysis system 1 can make it easier to utilize the analysis result data as big data, for example.

[0057] As one exemplary application, the analysis system 1 described above may be configured to estimate the gender, age, physique, social status, favoring, behavioral tendency,

or the like as the attribute of the person included in the image indicated by the first image data, thereby making it possible to provide the analysis result data applicable to various usages such as trade area survey, marketing, advertising, disaster prevention planning, and urban planning.

[0058] [Second Embodiment]

An analysis system according to a second embodiment is different from the first embodiment in that analysis is carried out by taking second analysis material data into consideration as well. In the following, like constituent elements similar to those in the embodiment above are labelled in the same manner, and explanation of configurations, effects, and advantages common to the embodiment will be omitted as much as possible (and so forth).

[0059] An analysis system 201 according to the present embodiment as illustrated in FIG. 4 is different from the analysis system 1 as described above in that the analysis system 201 includes a recording device 210 as a moving object analysis data collecting device instead of the recording device 10. The analysis system 201 is configured substantially similarly to the analysis system 1 in terms of the other features. The recording device 210 is different from the recording device 10 in that the recording device 210 further includes an internal view camera 215 in addition to an external view camera 11, a positional information measuring unit 12, a data input/output section 13, and a control section 14. The recording device 210 is configured substantially similarly to the recording device 10 in terms of the other features.

[0060] The recording device 210 according to the present embodiment is configured to collect, as analysis material

data for analysis performed by an analysis device 20, the second analysis material data as well as the first analysis material data. The second analysis material data is data including second image data indicative of an image of an internal view of the moving object V, and second positional data indicative of a location at which capturing of the image of the internal view of the moving object V was performed. The recording device 210 is configured to collect the second image data and the second positional data as the second analysis material data. The second image data is collected by use of the internal view camera 215 as described above.

[0061] The internal view camera 215 is an internal view image capturing device for capturing an image of the internal view inside the moving object V, that is, an in-vehicle view image. The internal view camera 215 is configured to capture an image of the internal view of the moving object V, thereby collecting the second image data indicative of the image of the internal view of the moving object V. Typically, the internal view camera 215 may be configured to capture a moving image of the internal view inside the moving object V. The internal view camera 215 is positioned in the moving object V at such an angle of view that allows an image of a person to be analyzed by the analysis system 201, who is a passenger, etc. inside the moving object V herein, to be captured. It may be so configured that a plurality of the internal view cameras 215 is provided on a celling portion and the like inside the moving object V, so that the capturing of an image of a person inside the moving object V can be performed more appropriately. The internal view camera 215 may be a monocular camera and may be a stereo camera. Moreover, the image to be captured by the internal view camera 215 may be

a black-and-white image or a color image. The control section 14 is also communicably connected with the internal view camera 215, and configured to be capable of transmitting and receiving various signals and data from each other. The internal view camera 215 is configured to output to the control section 14 the second image data thus collected.

[0062] Moreover, the positional information measuring unit 12 is further configured to collect the second positional data indicative of a location at which the capturing of the image of the internal view of the moving object V was performed, as well as the first positional data. The positional information measuring unit 12 is further configured to output to the control section 14 the second positional data thus collected, as well as the first positional data.

[0063] The processing section 14B is configured to control operations of the internal view camera 215 and the positional information measuring unit 12, so as to carry out the process for collecting the second analysis material data including the second image data and the second positional data, in addition to the process for collecting the first analysis material data. Moreover, the storage section 14A is configured to store the second analysis material data together with a time or the like at which the collecting of the second analysis material data was performed. In other words, similarly to the first analysis material data, the second analysis material data includes time data indicative of the time at which the second analysis material data was collected, or the other data. Moreover, the data input/output section 13 is capable of outputting the second analysis material data to the analysis device 20 in addition to the first analysis

material data. The processing section 14B is configured to carry out a process for outputting the second analysis material data to the analysis device 20 via the data input/output section 13.

[0064] Furthermore, the analysis device 20 according to the present embodiment is configured to analyze the second analysis material data as well as the first analysis material data thus collected by the recording device 210, and to provide analysis result data indicative of an analysis result of the analysis to the client terminal CL.

[0065] The data input/output section 21 is capable of receiving the second analysis material data as well as the first analysis material data from the recording device 210. Moreover, the analysis target DB 22A is configured to accumulate and store, as a database, the second analysis material data (such as the second image data, the second positional data, and the time data), which is the analysis target data to be analyzed by the processing section 23, as well as the first analysis material data. The second analysis material data thus inputted into the data input/output section 21 from the recording device 210 is stored into the analysis target DB 22A. Furthermore, the analysis reference data stored in the analysis reference DB 22B is also referred to by the processing section 23 in analyzing the second analysis material data.

[0066] The data preprocessing section 23A is configured to carry out various preprocesses to the second analysis material data, which is the analysis target data, in a manner similar to these for the first analysis material data. Furthermore, the data analysis processing section 23B is configured to analyze, on the basis of the second analysis material data thus preprocessed by the data preprocessing section 23A, an attribute of the person

included in the image indicated by the second image data, and a flow of people whose attributes have been determined. The data analysis processing section 23B is configured to analyze the second analysis material data similarly to the analysis of the first analysis material data as described above, and generate, as the analysis result data, personal attribute data indicative of the attribute of the person included in the image indicated by the second image data, and attribute-based categorized people's flow data indicative of the flow of people whose attributes have been determined. The analysis result DB 22C is configured to accumulate and store, as a database, the analysis result data indicative of the analysis result of the analysis of the second analysis material data performed by the data analysis processing section 23B, similarly to the analysis result data indicative of the analysis result of the analysis of the first analysis material data. The analysis result data includes the personal attribute data indicative of the attribute of the person included in the image indicated by the second image data, the attribute-based categorized people's flow data indicative of the flow of people whose attributes have been determined, and the like data. Furthermore, the data processing section 23C is configured to process the personal attribute data, and the attribute-based categorized people's flow data included in the analysis result data, into a desired format as described above. Moreover, the processing section 23 is configured to output and provide the analysis result data thus processed into the desired format by the data processing section 23C, to the client terminal CL via the data input/output section 21.

[0067] Similarly to the analysis system 1, the analysis system 201 as described above can ensure collection of a

relatively large amount of the first analysis material data available for the analysis performed by the analysis device 20, thereby making it possible to facilitate the improvement of the analysis accuracy.

[0068] In addition to this, the analysis system 201 as described above can also collect, by the recording device 210, the analysis material data including the second image data indicative of the image of the internal view of the moving object V and the second positional data corresponding to the second image data, and provide the second analysis material data to the analysis performed by the analysis device 20. As a result, the analysis system 201 can obtain analysis result data in which the attributes and flows of not only the people on the road on which the moving object V drives, but also the people inside the moving object V (passenger) are taken into consideration, thereby making it possible to further facilitate the improvement of the analysis accuracy. Because of this, the analysis system 201 can, for example, make it possible to provide the analysis result data applicable to such usages as analysis of attributes of passengers of buses or taxies, locations at which the passengers got on or got off the buses or taxies, and flows of people after the getting-on and getting-off, and optimization of efficiencies of bus services and taxi dispatches, and the like.

[0069] [Third Embodiment]

An analysis system according to a third embodiment is different from the second embodiment in that analysis is carried out by taking third analysis material data into consideration as well.

[0070] An analysis system 301 according to the present embodiment as illustrated in FIG. 5 is different from the analysis system 201 as described above in that the analysis

system 301 further includes a recording device 310 as a fixed-position object analysis data collecting device mounted on a fixed-position object F, in addition to the recording device 210 mounted on the moving object V. The analysis system 301 is configured substantially similarly to the analysis system 201 in terms of the other features.

[0071] The recording device 310 according to the present embodiment is configured to be mounted on the fixed-position object F provided on a road, and is different from the recording device 10 (see in FIG. 1) as described above or the recording device 210 as described above in that the mounting object for the recording device 310 is the fixed-position object F. The recording device 310 is configured substantially similarly to the recording device 10 as described above, and explanation of the recording device 310 is omitted here. Therefore, for components of the recording device 310, the components of the recording device 10 as illustrated in FIG. 1 will be referred to as appropriate in the following.

[0072] Here, the fixed-position object F on which the recording device 310 according to the present embodiment is mounted is an object fixedly installed on a road. The fixed-position object F may be, for example, a bus stop, a digital signage, a vending machine, a sign, a utility pole, or the like, or an object provided specially for installing the recording device 310 thereon.

[0073] The recording device 310 according to the present embodiment is configured to further collect the third analysis material data as analysis material data for the analysis performed by the analysis device 20. The third analysis material data is data including third image data indicative of an image of an external view viewed from the fixed-position object F, the image being captured by the

recording device 310 as mounted on the fixed-position object F, and third positional data indicative of a location at which the capturing of the image of the external view viewed from the fixed-position object F was performed. The recording device 310 is configured to collect the third image data and the third positional data as the third analysis material data. The third image data is collected by an external view camera 11 (see FIG. 1) as described above.

[0074] In this case, the external view camera 11 is mounted on the fixed-position object F at such an angle of view that allows an image of a person to be analyzed by the analysis system 1, that is, a person on the road in the external view of the fixed-position object F, to be captured. It may be configured such that a plurality of the external view cameras 11 is provided on the fixed-position object F, so that the capturing of an image of a person on a road from fixed-position object F can be performed more appropriately. The external view camera 11 is configured to output the third image data thus collected to a control section 14.

[0075] Moreover, the positional information measuring unit 12 (see in FIG. 1) is configured to collect the third positional data indicative of a location at which the capturing of the image of the external view viewed from the fixed-position object F was performed. The positional information measuring unit 12 is configured to output to the control section 14 the third positional data thus collected.

[0076] The processing section 14B (see in FIG. 1) is configured to control operations of the external view camera 11 and the positional information measuring unit 12, so as to carry out the process for collecting the third

analysis material data including the third image data and the third positional data. Moreover, the storage section 14A (see in FIG. 1) is configured to store the third analysis material data together with a time or the like at which the collecting of the third analysis material data was performed. In other words, similarly to the first analysis material data or the like, the third analysis material data includes time data indicative of the time at which the third analysis material data was collected, or the other data. Moreover, the data input/output section 13 (see in FIG. 1) is capable of outputting the third analysis material data to the analysis device 20. The processing section 14B is configured to carry out a process for outputting the third analysis material data to the analysis device 20 via the data input/output section 13.

[0077] Furthermore, the analysis device 20 according to the present embodiment is configured to analyze the third analysis material data collected by the recording device 310 as well as the first analysis material data and the second analysis material data thus collected by the recording device 210, and to provide analysis result data indicative of an analysis result of the analysis to the client terminal CL.

[0078] The data input/output section 21 is capable of receiving the third analysis material data as well as the first analysis material data and the second analysis material data from the recording device 310. Moreover, the analysis target DB 22A is configured to accumulate and store, as a database, the third analysis material data (such as the third image data, the third positional data, and the time data), which is the analysis target data to be analyzed by the processing section 23, in addition to the first analysis material data and the second analysis

material data. The third analysis material data thus inputted into the data input/output section 21 from the recording device 310 is stored into the analysis target DB 22A. Furthermore, the analysis reference data stored in the analysis reference DB 22B is also referred to by the processing section 23 in analyzing the third analysis material data.

[0079] The data preprocessing section 23A is configured to carry out various preprocesses to the third analysis material data, which is the analysis target data, in a manner similar to these for the first analysis material data and the second analysis material data. Furthermore, the data analysis processing section 23B is configured to analyze, on the basis of the third analysis material data thus preprocessed by the data preprocessing section 23A, an attribute of the person included in the image indicated by the third image data, and a flow of people whose attributes have been determined. The data analysis processing section 23B is configured to analyze the third analysis material data similarly to the analysis of the first analysis material data and the second analysis material data as described above, and generate, as the analysis result data, personal attribute data indicative of the attribute of the person included in the image indicated by the third image data, and attribute-based categorized people's flow data indicative of the flow of people whose attributes have been determined. The analysis result DB 22C is configured to accumulate and store, as a database, the analysis result data indicative of the analysis result of the analysis of the third analysis material data performed by the data analysis processing section 23B, similarly to the analysis result data indicative of the analysis result of the analysis of the first analysis material data and the second

analysis material data. The analysis result data includes the personal attribute data indicative of the attribute of the person included in the image indicated by the third image data, the attribute-based categorized people's flow data indicative of the flow of people whose attributes have been determined, and the like data. Furthermore, the data processing section 23C is configured to process the personal attribute data, and the attribute-based categorized people's flow data included in the analysis result data, into a desired format as described above. Moreover, the processing section 23 is configured to output and provide the analysis result data thus processed into the desired format by this data processing section 23C, to the client terminal CL via the data input/output section 21.

[0080] Similarly to the analysis systems 1 and 201, the analysis system 301 as described above can ensure collection of a relatively large amount of the first analysis material data available for the analysis performed by the analysis device 20, thereby making it possible to facilitate the improvement of the analysis accuracy.

[0081] Moreover, the analysis system 301 as described above can obtain analysis result data in which the attributes and flows of not only the people on the road on which the moving object V drives, but also the people inside the moving object V (passenger) are taken into consideration, thereby making it possible to further facilitate the improvement of the analysis accuracy, as in the analysis system 201.

[0082] In addition to this, the analysis system 301 as described above can collect, by the recording device 310, the third analysis material data including the third image data indicative of the image of the external view viewed from the fixed-position object F and the third positional

data corresponding to the third image data, and provide the third analysis material data to the analysis performed by the analysis device 20. As a result, the analysis system 301 can add, as analysis material data for use in analyzing a person on a road, the third analysis material data collected by the recording device 310 mounted on the fixed-position object F. Therefore, the analysis system 301 can further facilitate the improvement of the analysis accuracy.

[0083] It should be noted that analysis systems according to embodiments of the present invention are not limited to the embodiments described above, and may be variously modified within the scopes recited in claims. Analysis systems according to the present embodiments may be configured by combining any of the constitute elements of the embodiments described above and modifications as appropriate.

[0084] The analysis systems 1, 201, and 301 as described above may further use, as analysis material data for use in the analysis, data collected by using a particular application, a self-administered questionnaire, a material summarized by a particular person, or the like.

[0085] The control sections 14 and the analysis devices 20 described above may be configured with the components separately constituted and connected with each other communicably to transmit and receive various electric signals from/to each other, and may be configured such that a part of the functions thereof are realized on another control device. Moreover, the programs, applications, various data, and the like described above may be updatable as appropriate, and may be stored in a server connected with the analysis system 1, 201, or 301 via any network. The programs, applications, various data, and the like described above may be provided by, for example,

downloading the whole or part thereof as needed. Moreover, the whole or any part of the process functions provided in the control sections 14 and the analysis devices 20 may be realized by, for example, a CPU or the like and a program interpreted and executed by the CPU or the like, or may be realized as hardware with wired logic or the like.

Reference Signs List

[0086] 1, 201, 301 Analysis system

10, 210 Recording device (Moving object analysis data collecting device)

20 Analysis device(Data analysis device)

14A, 22 Storage section

310 Recording device (Fixed-position object analysis data collecting device)

F Fixed-position object

V Moving object

CLAIMS

1. An analysis system, comprising:

a moving object analysis data collecting device mounted on a moving object and configured to collect first analysis material data including first image data indicative of an image of an external view viewed from the moving object, the image being captured during traveling of the moving object, and first positional data indicative of a location at which the capturing of the image of the external view viewed from the moving object was carried out; and

a data analysis device configured to analyze, on a basis of the first analysis material data thus collected by the moving object analysis data collecting device, an attribute of a person included in the image indicated by the first image data, and a flow of people whose attributes have been thus determined.

2. The analysis system according to claim 1, wherein

the data analysis device is configured to extract an image including a feature point of the person from among a plurality of the images of the first image data, the feature point being such that an attribute of the person can be determined from the feature point, and to analyze, on a basis of the image thus extracted, the attribute of the person included in the image.

3. The analysis system according to claim 1 or 2, wherein

the moving object analysis data collecting device is further configured to collect second analysis material data including second image data indicative of an image of an internal view of the moving object, and second positional data indicative of a location at which the capturing of the

image of the internal view of the moving object was carried out, and

the data analysis device is further configured to analyze, on a basis of the second analysis material data thus collected by the moving object analysis data collecting device, an attribute of a person included in the image indicated by the second image data, and a flow of people whose attributes have been determined.

4. The analysis system according to any one of claims 1 to 3, comprising:

a fixed-position object analysis data collecting device mounted on a fixed-position object provided on a road, and configured to collect third analysis material data including third image data indicative of an image of an external view viewed from the fixed-position object, the image being captured by the fixed-position object analysis data collecting device as mounted on the fixed-position object, and third positional data indicative of a location at which the capturing of the image of the external view viewed from the fixed-position object was carried out, wherein

the data analysis device is further configured to analyze, on a basis of the third analysis material data thus collected by the fixed-position object analysis data collecting device, an attribute of a person included in the image indicated by the third image data, and a flow of people whose attributes have been determined.

5. The analysis system according to any one of claims 1 to 4, wherein

the moving object is a moving object that drives in a predetermined route repeatedly.

6. The analysis system according to any one of claims 1 to 5, wherein

the data analysis device includes a storage section configured to accumulate analysis result data indicative of an analysis result analyzed by the data analysis device.

7. The analysis system according to any one of claims 1 to 6, wherein

the attribute of the person to be analyzed by the data analysis device includes his/her gender, age, physique, social status, favoring, or behavioral tendency.