DESCRIPTION

TITLE OF INVENTION

TRAFFIC SIGNAL CONTROL ~~DEVICE~~APPARATUS, TRAFFIC SIGNAL CONTROL METHOD, AND COMPUTER PROGRAM

TECHNICAL FIELD

[0001]

The present invention relates to a traffic signal control apparatus, a traffic signal control method, and a computer program for controlling signal light colors of traffic signal units on the basis of traffic volumes.

BACKGROUND ART

[0002]

When conventional traffic signal control methods based on coordinated control and wide-area control are roughly classified in terms of methods for setting signal control parameters (split, cycle length, offset, etc.), there are two types of control methods, i.e., fixed-time control in which signal control parameters are set according to time zones, and traffic actuated control in which signal control parameters are set according to traffic conditions.

Of the above control methods, the traffic actuated control is classified into: terminal actuated control performed for each of traffic signal controllers of terminals; and central actuated control in which signal control parameters are changed over a plurality of intersections that are subjected to route coordinated control or area control.

[0003]

The above-mentioned central actuated control enables advanced coordinated control and wide-area control (area control) adaptive to change in traffic flow, and therefore is

information S4) cannot be obtained are shown in the part of the control area.

Hereinafter, signal control relating to the first intersections Ci-1 will be described.

[0078]

[6.1 Signal control at first intersection]

The (control processing unit 412 of) central device 4, as described above, executes the MODERATO control in which signal control is performed with a most appropriate signal control parameter generated by using a demand factor.

In order to obtain a demand factor, firstly, the central device 4 receives the road side measurement information S4 transmitted from the road side sensor 3 through the traffic signal controller 1a (step S101), and then the central device 4 obtains an inflow traffic volume (number of vehicles/time) and a queue length (number of vehicles) at an intersection Ci-1 as a control target, on the basis of the road side measurement information S4 (step S102).

[0079]

The manner of obtaining a queue length by the (measurement processing unit 410 of) central device 4 will be described below.

FIG. 8 is a diagram showing an example of a method for obtaining a waiting queue length.

As shown in FIG. 8, the central device 4 obtains the speeds of vehicles traveling on the road, on the basis of the road side measurement information S4 obtained by a plurality of the road side sensors 3 located at predetermined positions on the upstream side of the stop line of the target intersection Ci, and obtains a waiting queue spreading degree from the speeds. FIG. 8 shows an exemplary case in which the road side sensor 3 is installed at positions 150 m, 300 m, and 500 m apart from the stop line of the intersection Ci. These positions of the road side sensors 3 are merely examples, and a plurality of the road side sensors 3 may be installed in a range of about 100 m to 500 m~~m~~.

[0080]

can be approximated to a value obtained by multiplying the inflow traffic volume $Q_3(t-1)$ toward the downstream side first intersection Ci-1 by coefficient h(t).

Also in this case, since the inflow traffic volume $Q_3(t)$ toward the downstream side first intersection Ci-1 can be acquired by the road side sensor 3, an estimated value of the inflow traffic volume $Q_2(t)$ toward the second intersection Ci-2 can be calculated by using the equation (7).

It is noted that the coefficient h(t) is set to different values for different time zones as shown in (b) of FIG. 9, on the basis of preliminary investigation for correlation between the downstream side first intersection Ci-1 and the second intersection Ci-2.

[0103]

As described above, the estimated inflow traffic volume toward the second intersection Ci-2 can also be obtained on the basis of the inflow traffic volume of the adjacent downstream side first intersection Ci-1.

Thus, the estimated inflow traffic volume toward the second intersection Ci-2 can be obtained by using either the inflow traffic volume of the adjacent upstream side first intersection Ci-1 or the inflow traffic volume of the adjacent downstream side first intersection Ci-1.

It is noted that in (b) of FIG. 9, "p.m." and "a.m." indicate "afternoon" and "before noon", respectively. For example, "3 p.m." indicates "three o'clock in the afternoon".

[0104]

Referring back to FIG. 7, the central device 4 further causes the estimation processing unit 411 to obtain a queue length at the second intersection Ci-2 (step S206).

Since the road side sensor 3 for obtaining an inflow traffic volume is not installed on the upstream side of the second intersection Ci-2 as the control target, it is not possible to obtain the queue length on the basis of the road side measurement information S4 from the road

CLAIMS

1. (Amended) A traffic signal control apparatus comprising:

an acquisition unit configured to acquire an inflow traffic volume at a first intersection defined below;

an estimation unit configured to estimate an inflow traffic volume at a second intersection defined below, on the basis of the acquired inflow traffic volume at the first intersection;

an information processing unit configured to generate a signal control parameter for a first controller defined below, on the basis of the acquired inflow traffic volume at the first intersection, and generate a signal control parameter for a second controller defined below, on the basis of the estimated inflow traffic volume at the second intersection; and

a communication unit configured to transmit the generated signal control parameter for the first controller to the first controller, and to transmit the generated signal control parameter for the second controller to the second controller, wherein

first intersection: an intersection at which an inflow traffic volume can be obtained,

second intersection: an intersection at which an inflow traffic volume cannot be obtained,

first controller: a traffic signal controller installed at the first intersection, and

second controller: a traffic signal controller installed at the second intersection.

2. The traffic signal control apparatus according to claim 1, wherein

two control methods defined below are provided as switchable control methods to be performed on the second controller by the information processing unit, wherein

actuated method: a control method in which the signal control parameter for the second controller is generated on the basis of the estimated inflow traffic volume at the second

intersection; and

non-actuated method: a control method in which a preset signal control parameter or a signal control parameter being applied to an adjacent first controller is adopted as the signal control parameter for the second controller.

3. The traffic signal control apparatus according to claim 2, wherein

the information processing unit is capable of determining whether or not the first intersection is under congestion, on the basis of the inflow traffic volume at the first intersection, and

the information processing unit adopts the actuated method as the control method of the second controller in a case where the first intersection is under congestion, and adopts the non-actuated method as the control method of the second controller in a case where the first intersection in not under congestion.

4. The traffic signal control apparatus according to any one of claims 1 to 3, wherein

the information processing unit is capable of executing a subarea connection determination process of determining, on the basis of a traffic condition, whether or not a plurality of intersections adjacent to each other should be included in the same subarea, and

in the determination process, the information processing unit treats the second intersection equally to the first intersection in a case where a predetermined condition is satisfied, and does not regard the second intersection as a target of subarea connection in a case where the predetermined condition is not satisfied.

5. The traffic signal control apparatus according to claim 4, wherein the predetermined condition is that the first intersection is under congestion.

6. The traffic signal control apparatus according to any one of claims 1 to 3, wherein the information processing unit is capable of executing a subarea connection determination process of determining, on the basis of a traffic condition, whether or not a plurality of intersections adjacent to each other should be included in the same subarea, and

the determination process includes:

calculating

a first evaluation value obtained from a predetermined evaluation condition in a case where signal control is performed with cycle lengths respectively set at a plurality of intersections adjacent to each other, and

a second evaluation value obtained from the predetermined evaluation condition in a case where signal control is performed such that each of the respective cycle lengths of the plurality of intersections adjacent to each other is set to be the same value as a cycle length which is obtained based on reliability indicating a degree of reliability obtained based on a process for obtaining a signal control parameter at each intersection; and

determining whether or not the plurality of intersections adjacent to each other should be included in the same subarea, on the basis of comparison between the first evaluation value and the second evaluation value.

7. (Amended) A traffic signal control method comprising:

acquiring an inflow traffic volume at a first intersection defined below;

estimating an inflow traffic volume at a second intersection defined below, on the basis of the acquired inflow traffic volume at the first intersection;

generating a signal control parameter for a first controller defined below, on the basis of the acquired inflow traffic volume at the first intersection, and generating a signal

control parameter for a second controller defined below, on the basis of the estimated inflow traffic volume at the second intersection; and

transmitting the generated signal control parameter for the first controller to the first controller, and transmitting the generated signal control parameter for the second controller to the second controller, wherein

first intersection: an intersection at which an inflow traffic volume can be obtained,

second intersection: an intersection at which an inflow traffic volume cannot be obtained,

first controller: a traffic signal controller installed at the first intersection, and

second controller: a traffic signal controller installed at the second intersection.

8. A computer program for causing a computer to function as the traffic signal control apparatus according to claim 1.

9. (Newly added) The traffic signal control apparatus according to claim 1, wherein the estimation unit estimates the inflow traffic volume at the second intersection defined below, on the basis of the acquired inflow traffic volume at the first intersection, and probe data acquired from a traveling vehicle.

CLAIMS

1. A traffic signal control apparatus comprising:

an acquisition unit configured to acquire an inflow traffic volume at a first intersection defined below;

an estimation unit configured to estimate an inflow traffic volume at a second intersection defined below, on the basis of the acquired inflow traffic volume at the first intersection;

an information processing unit configured to generate a signal control parameter for a first controller defined below, on the basis of the acquired inflow traffic volume at the first intersection, and generate a signal control parameter for a second controller defined below, on the basis of the estimated inflow traffic volume at the second intersection; and

a communication unit configured to transmit the generated signal control parameter for the first controller to the first controller, and to transmit the generated signal control parameter for the second controller to the second controller, wherein

first intersection: an intersection at which an inflow traffic volume can be obtained,

second intersection: an intersection at which an inflow traffic volume cannot be obtained,

first controller: a traffic signal controller installed at the first intersection, and

second controller: a traffic signal controller installed at the second intersection.

2. The traffic signal control apparatus according to claim 1, wherein

two control methods defined below are provided as switchable control methods to be performed on the second controller by the information processing unit, wherein

actuated method: a control method in which the signal control parameter for the second controller is generated on the basis of the estimated inflow traffic volume at the second

intersection; and

non-actuated method: a control method in which a preset signal control parameter or a signal control parameter being applied to an adjacent first controller is adopted as the signal control parameter for the second controller.

3. The traffic signal control apparatus according to claim 2, wherein

the information processing unit is capable of determining whether or not the first intersection is under congestion, on the basis of the inflow traffic volume at the first intersection, and

the information processing unit adopts the actuated method as the control method of the second controller in a case where the first intersection is under congestion, and adopts the non-actuated method as the control method of the second controller in a case where the first intersection in not under congestion.

4. The traffic signal control apparatus according to any one of claims 1 to 3, wherein

the information processing unit is capable of executing a subarea connection determination process of determining, on the basis of a traffic condition, whether or not a plurality of intersections adjacent to each other should be included in the same subarea, and

in the determination process, the information processing unit treats the second intersection equally to the first intersection in a case where a predetermined condition is satisfied, and does not regard the second intersection as a target of subarea connection in a case where the predetermined condition is not satisfied.

5. The traffic signal control apparatus according to claim 4, wherein the predetermined condition is that the first intersection is under congestion.

6. The traffic signal control apparatus according to any one of claims 1 to 3, wherein the information processing unit is capable of executing a subarea connection determination process of determining, on the basis of a traffic condition, whether or not a plurality of intersections adjacent to each other should be included in the same subarea, and

the determination process includes:

calculating

a first evaluation value obtained from a predetermined evaluation condition in a case where signal control is performed with cycle lengths respectively set at a plurality of intersections adjacent to each other, and

a second evaluation value obtained from the predetermined evaluation condition in a case where signal control is performed such that each of the respective cycle lengths of the plurality of intersections adjacent to each other is set to be the same value as a cycle length which is obtained based on reliability indicating a degree of reliability obtained based on a process for obtaining a signal control parameter at each intersection; and

determining whether or not the plurality of intersections adjacent to each other should be included in the same subarea, on the basis of comparison between the first evaluation value and the second evaluation value.

7. A traffic signal control method comprising:

acquiring an inflow traffic volume at a first intersection defined below;

estimating an inflow traffic volume at a second intersection defined below, on the basis of the acquired inflow traffic volume at the first intersection;

generating a signal control parameter for a first controller defined below, on the basis of the acquired inflow traffic volume at the first intersection, and generating a signal

control parameter for a second controller defined below, on the basis of the estimated inflow traffic volume at the second intersection; and

transmitting the generated signal control parameter for the first controller to the first controller, and transmitting the generated signal control parameter for the second controller to the second controller, wherein

first intersection: an intersection at which an inflow traffic volume can be obtained,

second intersection: an intersection at which an inflow traffic volume cannot be obtained,

first controller: a traffic signal controller installed at the first intersection, and

second controller: a traffic signal controller installed at the second intersection.

8. A computer program for causing a computer to function as the traffic signal control apparatus according to claim 1.

9. The traffic signal control apparatus according to claim 1, wherein the estimation unit estimates the inflow traffic volume at the second intersection, on the basis of the acquired inflow traffic volume at the first intersection, and probe data acquired from a traveling vehicle.