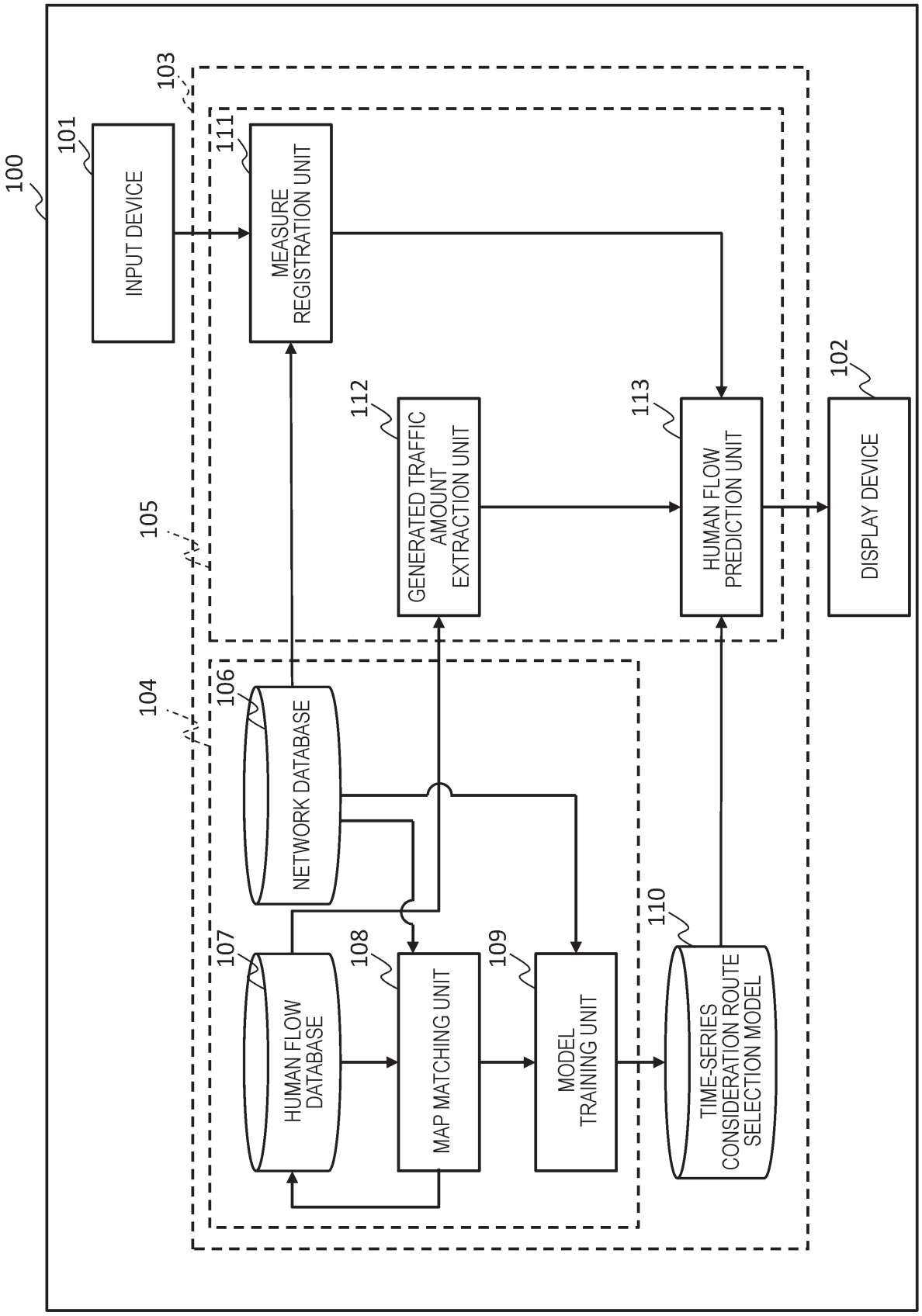
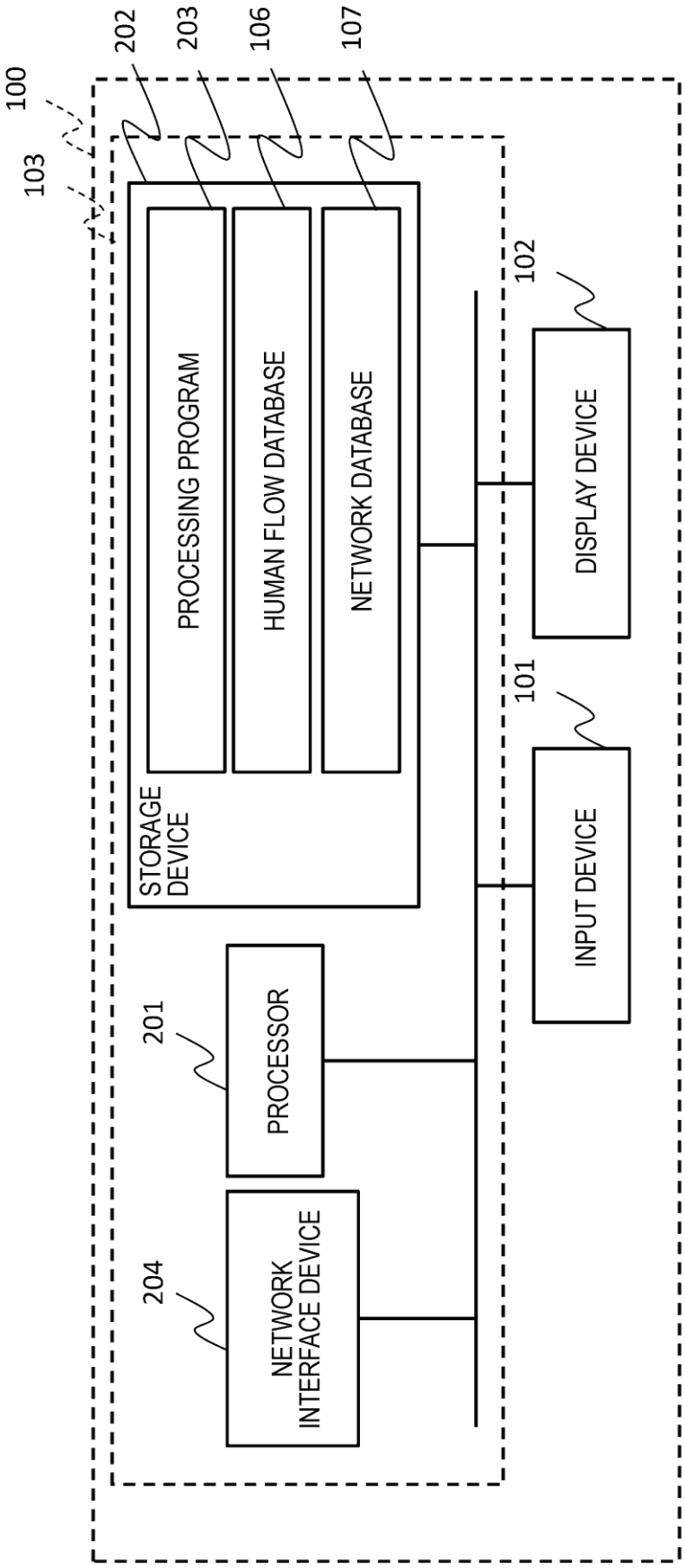
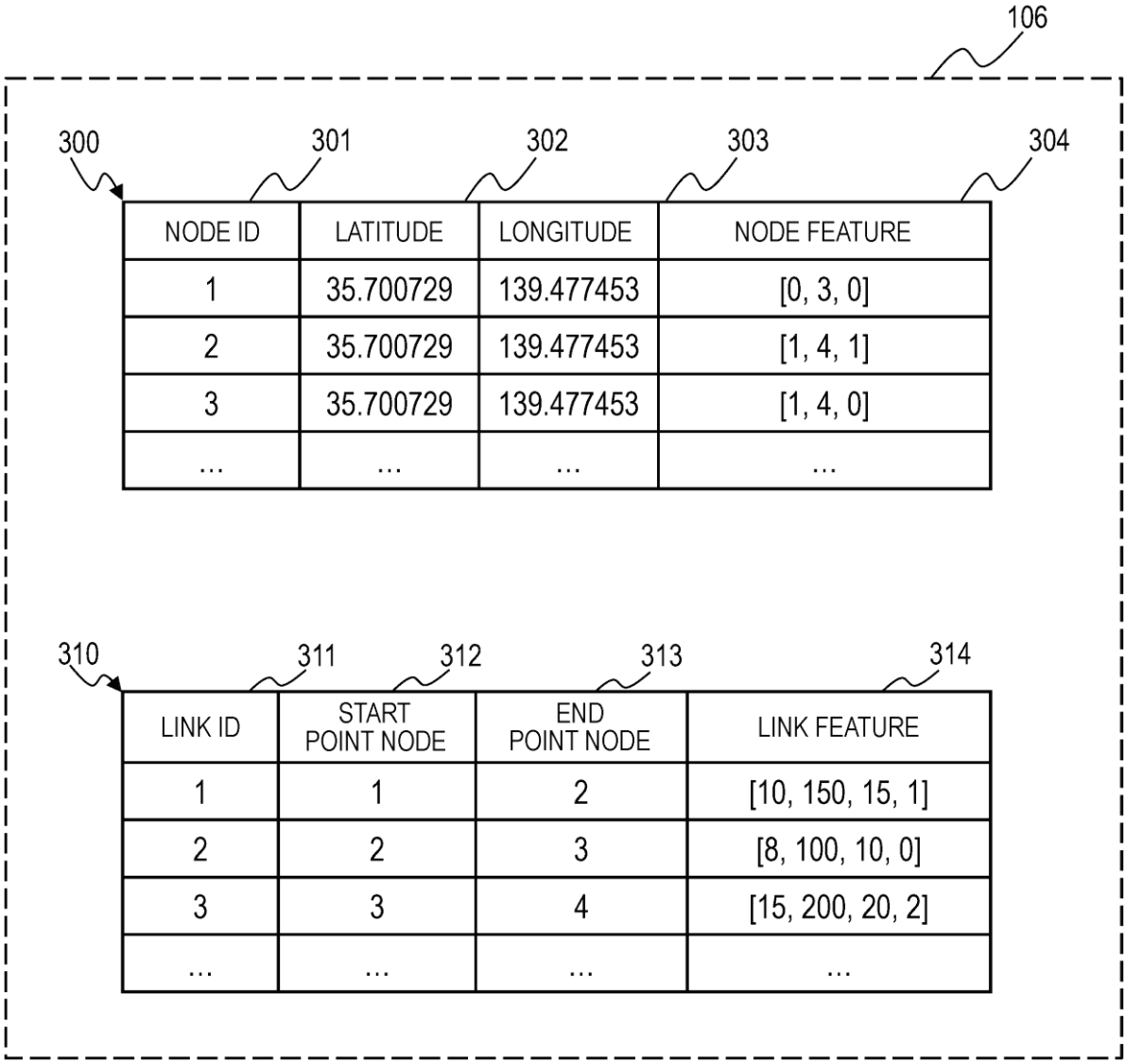
[FIG. 1]


100
101
INPUT DEVICE
103
111
MEASURE REGISTRATION UNIT
102
DISPLAY DEVICE
112
GENERATED TRAFFIC AMOUNT EXTRACTION UNIT
113
HUMAN FLOW PREDICTION UNIT
105
104
106
NETWORK DATABASE
107
HUMAN FLOW DATABASE
108
MAP MATCHING UNIT
109
MODEL TRAINING UNIT
110
TIME-SERIES CONSIDERATION ROUTE SELECTION MODEL

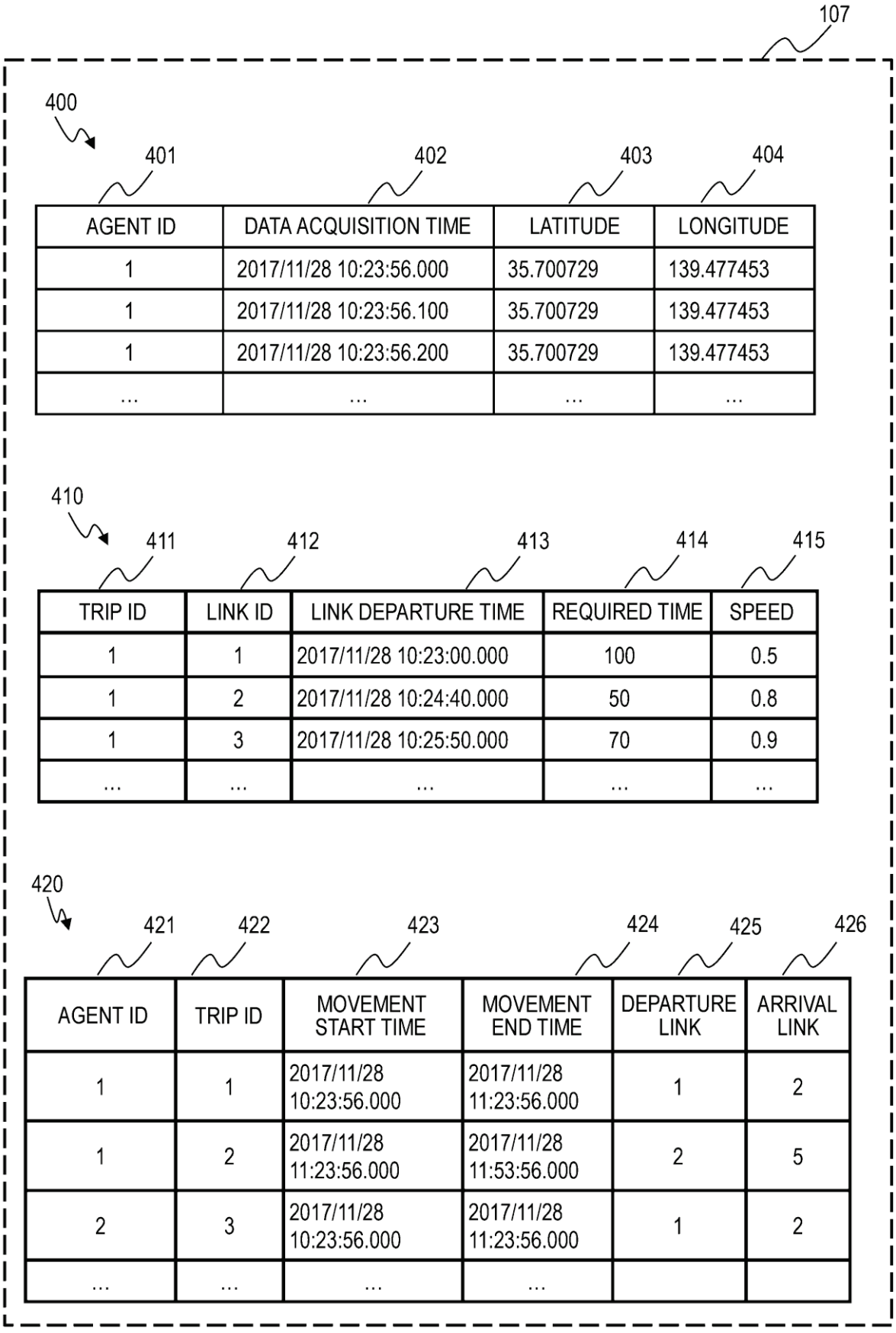
[FIG. 2]


100
103
202
203
106
107
PROCESSING PROGRAM
HUMAN FLOW DATABASE
NETWORK DATABASE
STORAGE DEVICE
102
DISPLAY DEVICE
101
INPUT DEVICE
201
PROCESSOR
204
NETWORK INTERFACE DEVICE

[FIG. 3]


106
300
301
302
303
304
NODE ID
LATITUDE
LONGITUDE
NODE FEATURE
1
35.700729
139.477453
[0, 3, 0]
2
35.700729
139.477453
[1, 4, 1]
3
35.700729
139.477453
[1, 4, 0]
...
310
311
312
313
314
LINK ID
START POINT NODE
END POINT NODE
LINK FEATURE
1
1
2
[10, 150, 15, 1]
2
2
3
[8, 100, 10, 0]
3
3
4
[15, 200, 20, 2]
...

[FIG. 4]

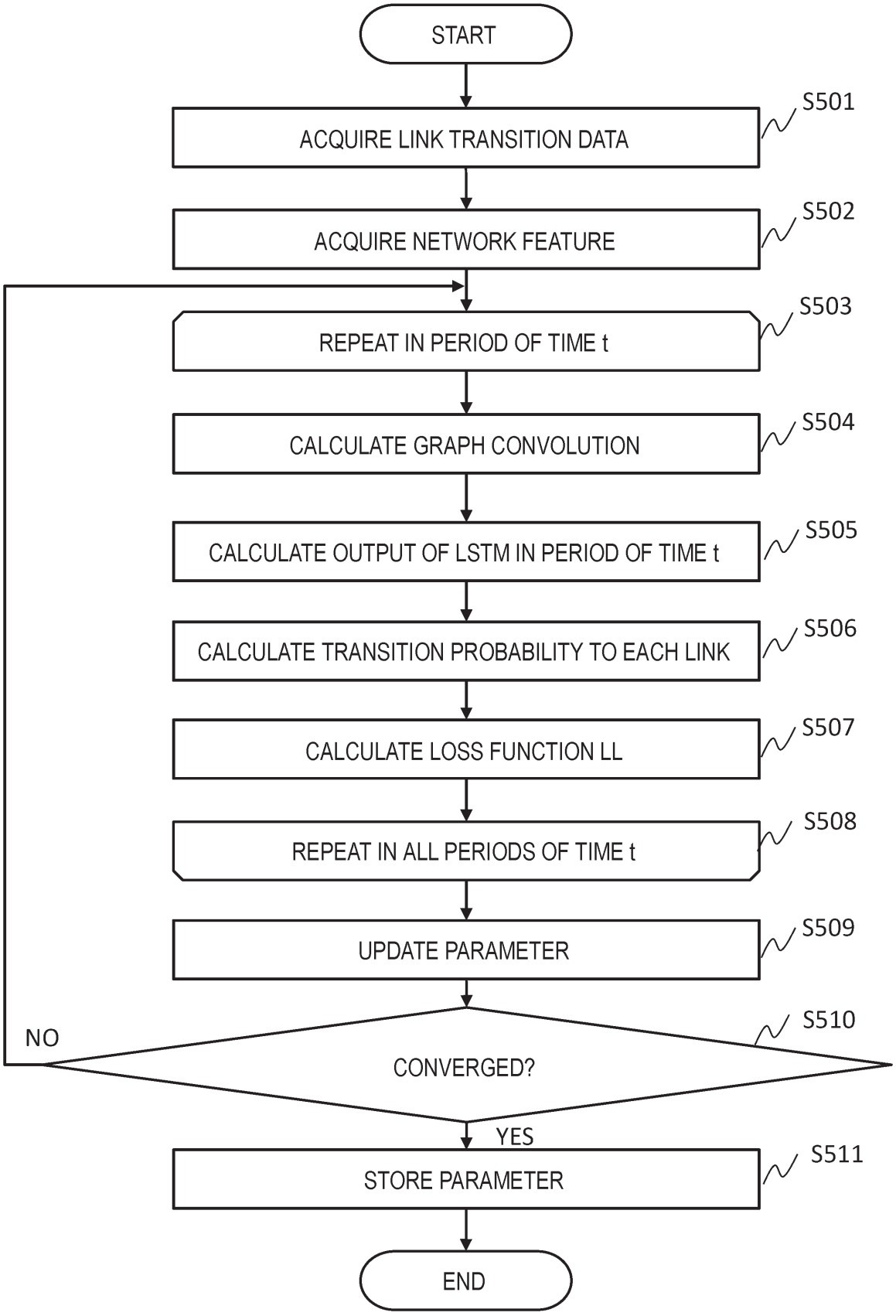


AGENT ID	DATA ACQUISITION TIME	LATITUDE	LONGITUDE
1	2017/11/28 10:23:56.000	35.700729	139.477453
1	2017/11/28 10:23:56.100	35.700729	139.477453
1	2017/11/28 10:23:56.200	35.700729	139.477453
…	…	…	…

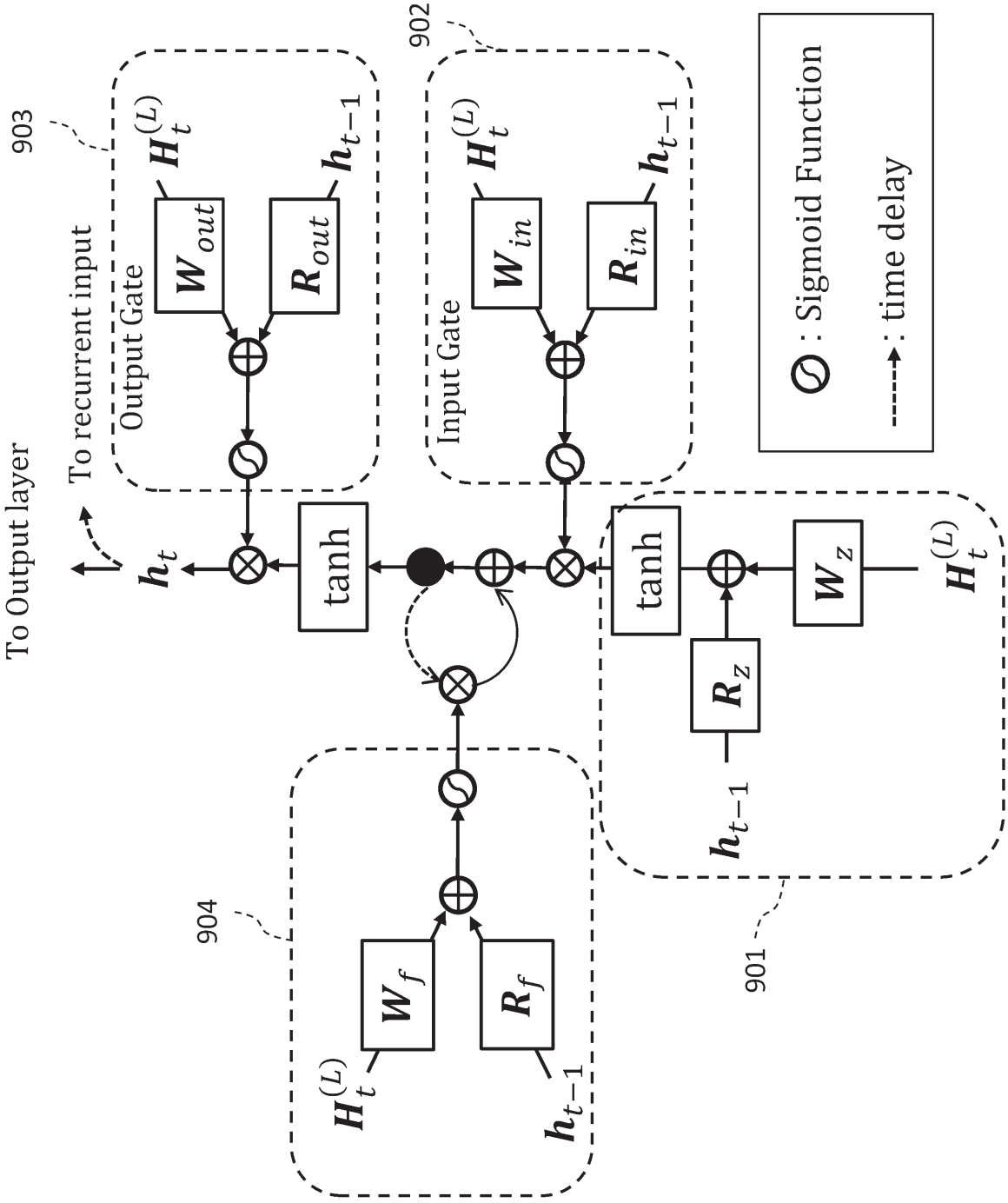
TRIP ID	LINK ID	LINK DEPARTURE TIME	REQUIRED TIME	SPEED
1	1	2017/11/28 10:23:00.000	100	0.5
1	2	2017/11/28 10:24:40.000	50	0.8
1	3	2017/11/28 10:25:50.000	70	0.9
…	…	…	…	…

AGENT ID	TRIP ID	MOVEMENT START TIME	MOVEMENT END TIME	DEPARTURE LINK	ARRIVAL LINK
1	1	2017/11/28 10:23:56.000	2017/11/28 11:23:56.000	1	2
1	2	2017/11/28 11:23:56.000	2017/11/28 11:53:56.000	2	5
2	3	2017/11/28 10:23:56.000	2017/11/28 11:23:56.000	1	2
…	…	…	…		

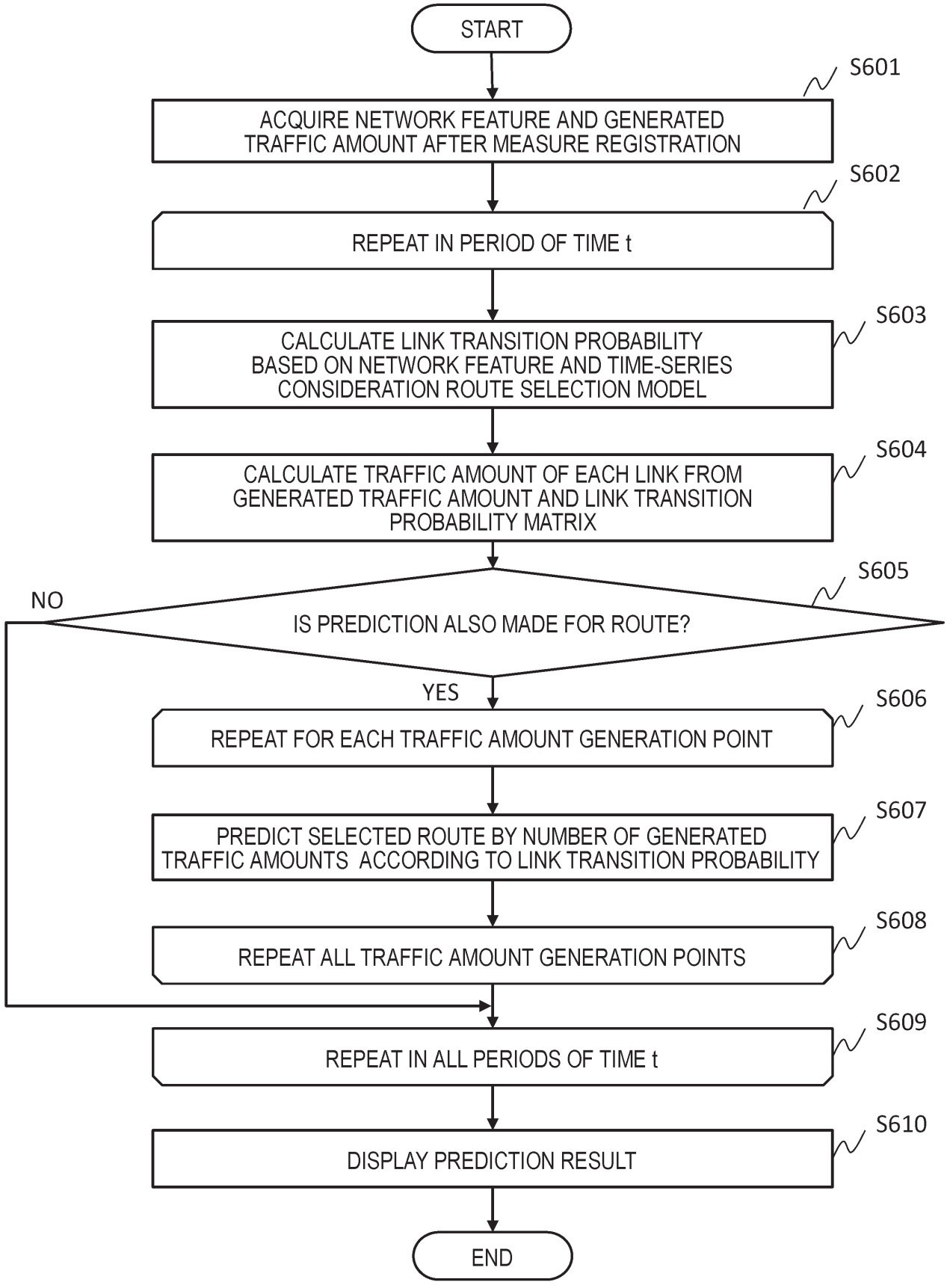
[FIG. 5]


START
ACQUIRE LINK TRANSITION DATA
S501
ACQUIRE NETWORK FEATURE
S502
REPEAT IN PERIOD OF TIME t
S503
CALCULATE GRAPH CONVOLUTION
S504
CALCULATE OUTPUT OF LSTM IN PERIOD OF TIME t
S505
CALCULATE TRANSITION PROBABILITY TO EACH LINK
S506
CALCULATE LOSS FUNCTION LL
S507
REPEAT IN ALL PERIODS OF TIME t
S508
UPDATE PARAMETER
S509
NO
CONVERGED?
S510
YES
STORE PARAMETER
S511
END

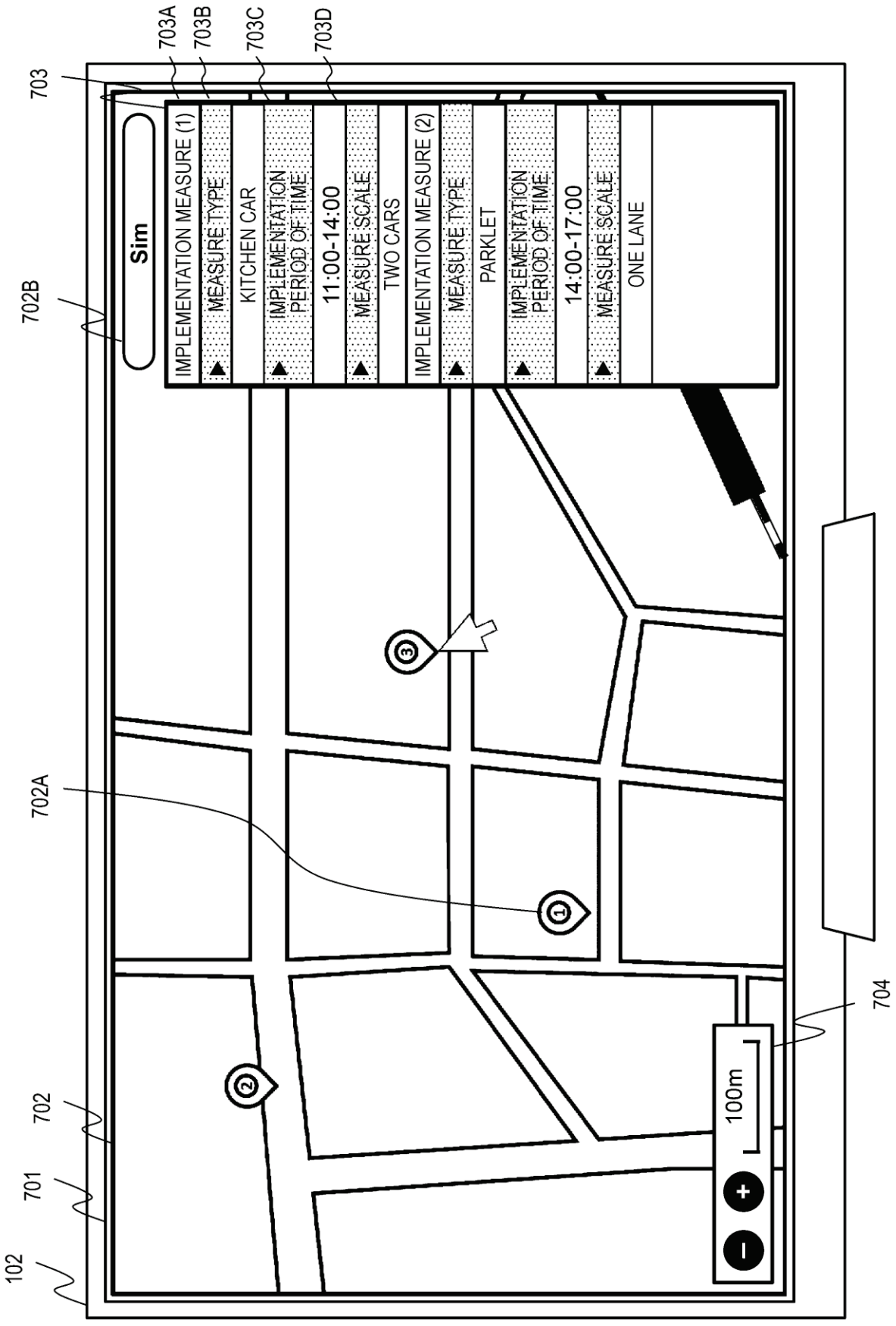
[FIG. 6]


To Output layer
To recurrent input
903
902
904
901
Output Gate
Input Gate
tanh
tanh
W_{out}
R_{out}
W_{in}
R_{in}
W_f
R_f
W_z
R_z
$H_t^{(L)}$
h_{t-1}
h_t
: Sigmoid Function
: time delay

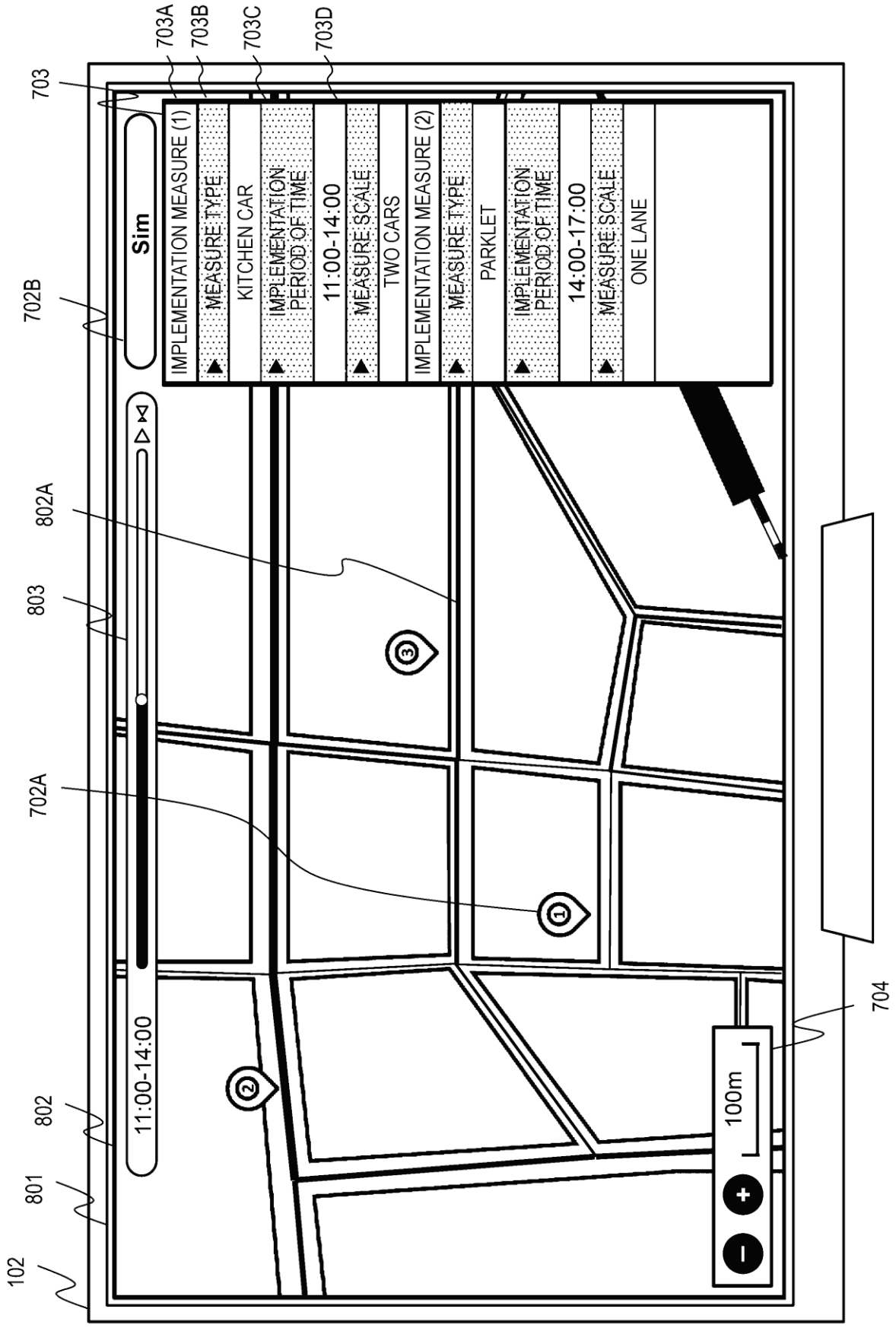
[FIG. 7]


START
S601
ACQUIRE NETWORK FEATURE AND GENERATED TRAFFIC AMOUNT AFTER MEASURE REGISTRATION
S602
REPEAT IN PERIOD OF TIME t
S603
CALCULATE LINK TRANSITION PROBABILITY BASED ON NETWORK FEATURE AND TIME-SERIES CONSIDERATION ROUTE SELECTION MODEL
S604
CALCULATE TRAFFIC AMOUNT OF EACH LINK FROM GENERATED TRAFFIC AMOUNT AND LINK TRANSITION PROBABILITY MATRIX
S605
IS PREDICTION ALSO MADE FOR ROUTE?
NO
YES
S606
REPEAT FOR EACH TRAFFIC AMOUNT GENERATION POINT
S607
PREDICT SELECTED ROUTE BY NUMBER OF GENERATED TRAFFIC AMOUNTS ACCORDING TO LINK TRANSITION PROBABILITY
S608
REPEAT ALL TRAFFIC AMOUNT GENERATION POINTS
S609
REPEAT IN ALL PERIODS OF TIME t
S610
DISPLAY PREDICTION RESULT
END

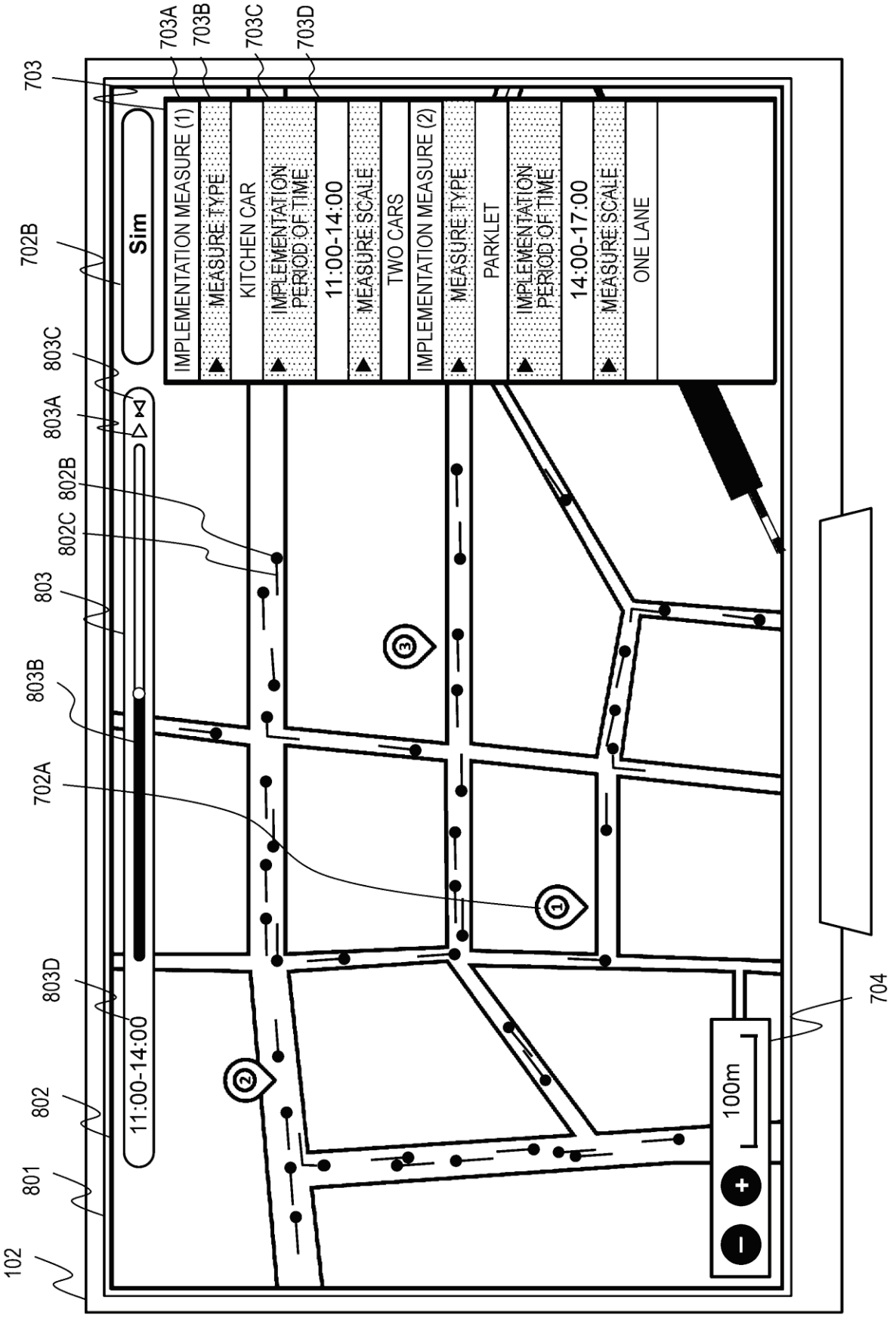
[FIG. 8]


703A
703B
703C
703D
703
702B
Sim
IMPLEMENTATION MEASURE (1)
MEASURE TYPE
KITCHEN CAR
IMPLEMENTATION PERIOD OF TIME
11:00-14:00
MEASURE SCALE
TWO CARS
IMPLEMENTATION MEASURE (2)
MEASURE TYPE
PARKLET
IMPLEMENTATION PERIOD OF TIME
14:00-17:00
MEASURE SCALE
ONE LANE
702A
702
701
102
704
100m
+
−

[FIG. 9]


703A
703B
703C
703D
703
IMPLEMENTATION MEASURE (1)
MEASURE TYPE
KITCHEN CAR
IMPLEMENTATION PERIOD OF TIME
11:00-14:00
MEASURE SCALE
TWO CARS
IMPLEMENTATION MEASURE (2)
MEASURE TYPE
PARKLET
IMPLEMENTATION PERIOD OF TIME
14:00-17:00
MEASURE SCALE
ONE LANE
Sim
11:00-14:00
100m
702B
802A
803
702A
802
801
102
704

[FIG. 10]


703
703A
703B
703C
703D
IMPLEMENTATION MEASURE (1)
MEASURE TYPE
KITCHEN CAR
IMPLEMENTATION PERIOD OF TIME
11:00-14:00
MEASURE SCALE
TWO CARS
IMPLEMENTATION MEASURE (2)
MEASURE TYPE
PARKLET
IMPLEMENTATION PERIOD OF TIME
14:00-17:00
MEASURE SCALE
ONE LANE
Sim
11:00-14:00
100m
102
801
802
803D
803B
803
802C
802B
803A
803C
702B
702A
704