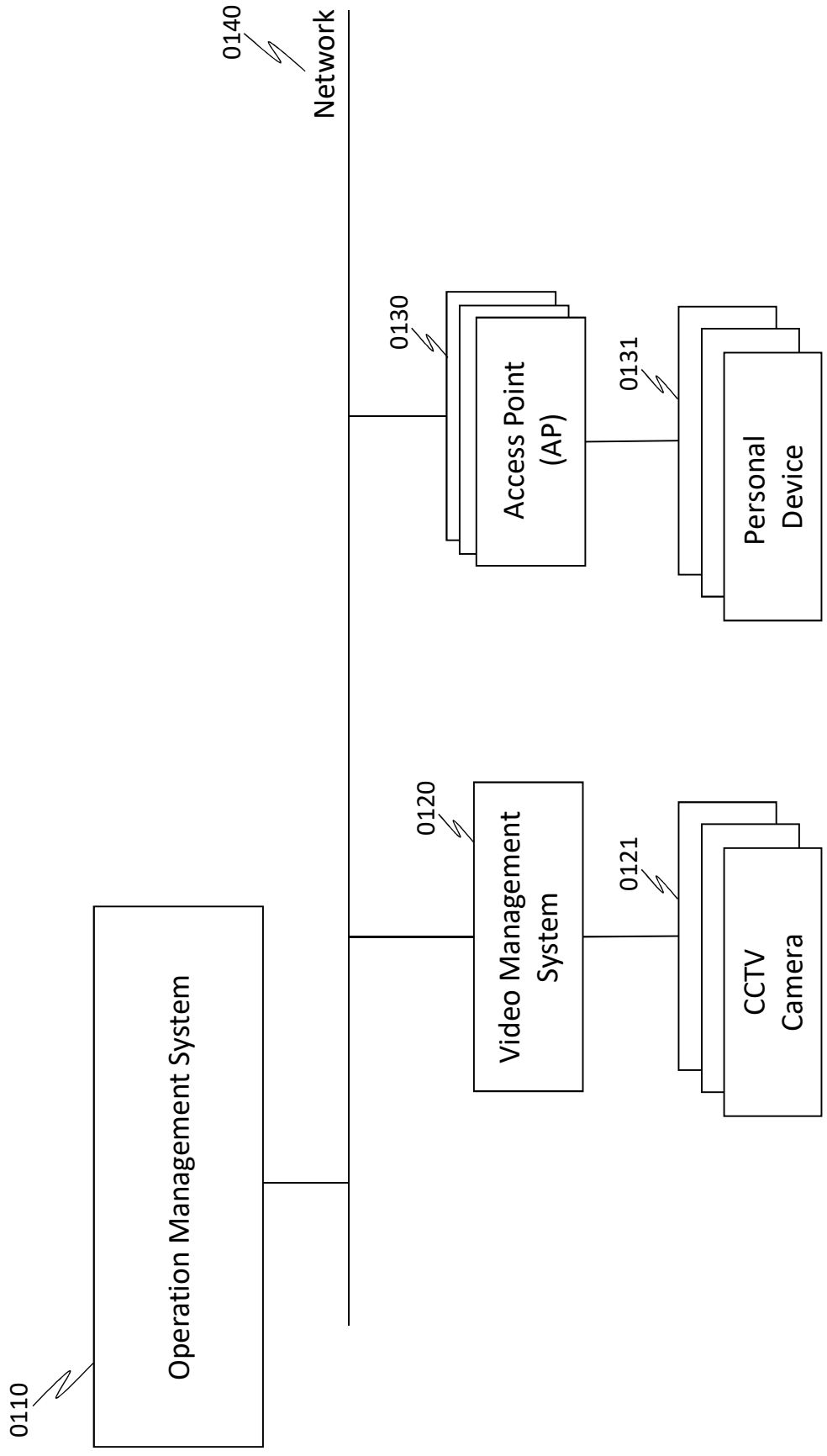

0140
Network
0130
Access Point
(AP)
0131
Personal
Device
0120
Video Management
System
0121
CCTV
Camera
0110
Operation Management System

FIG. 1

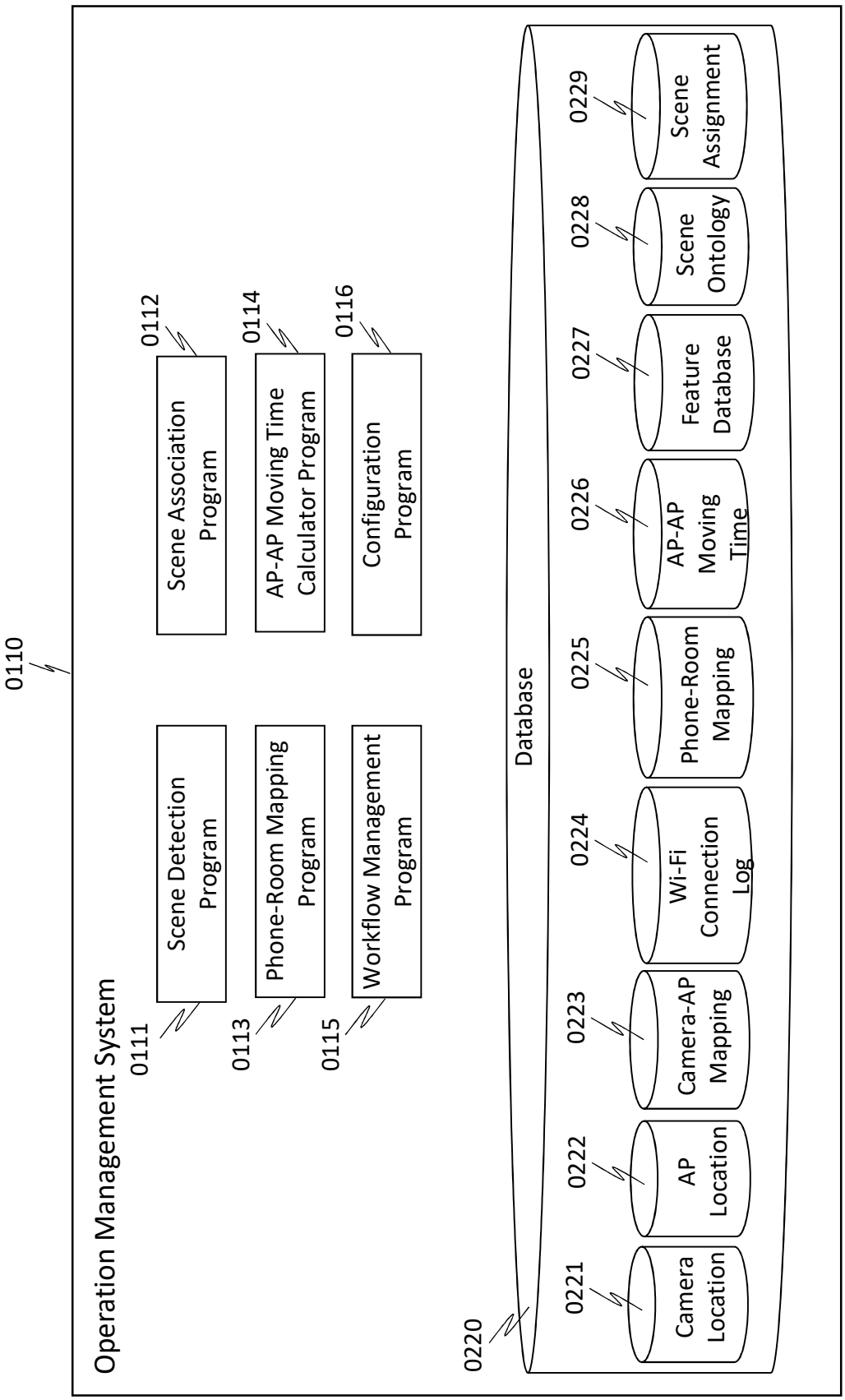

0110
Operation Management System
0111
Scene Detection Program
0112
Scene Association Program
0113
Phone-Room Mapping Program
0114
AP-AP Moving Time Calculator Program
0115
Workflow Management Program
0116
Configuration Program
0220
Database
0221
Camera Location
0222
AP Location
0223
Camera-AP Mapping
0224
Wi-Fi Connection Log
0225
Phone-Room Mapping
0226
AP-AP Moving Time
0227
Feature Database
0228
Scene Ontology
0229
Scene Assignment

FIG. 2

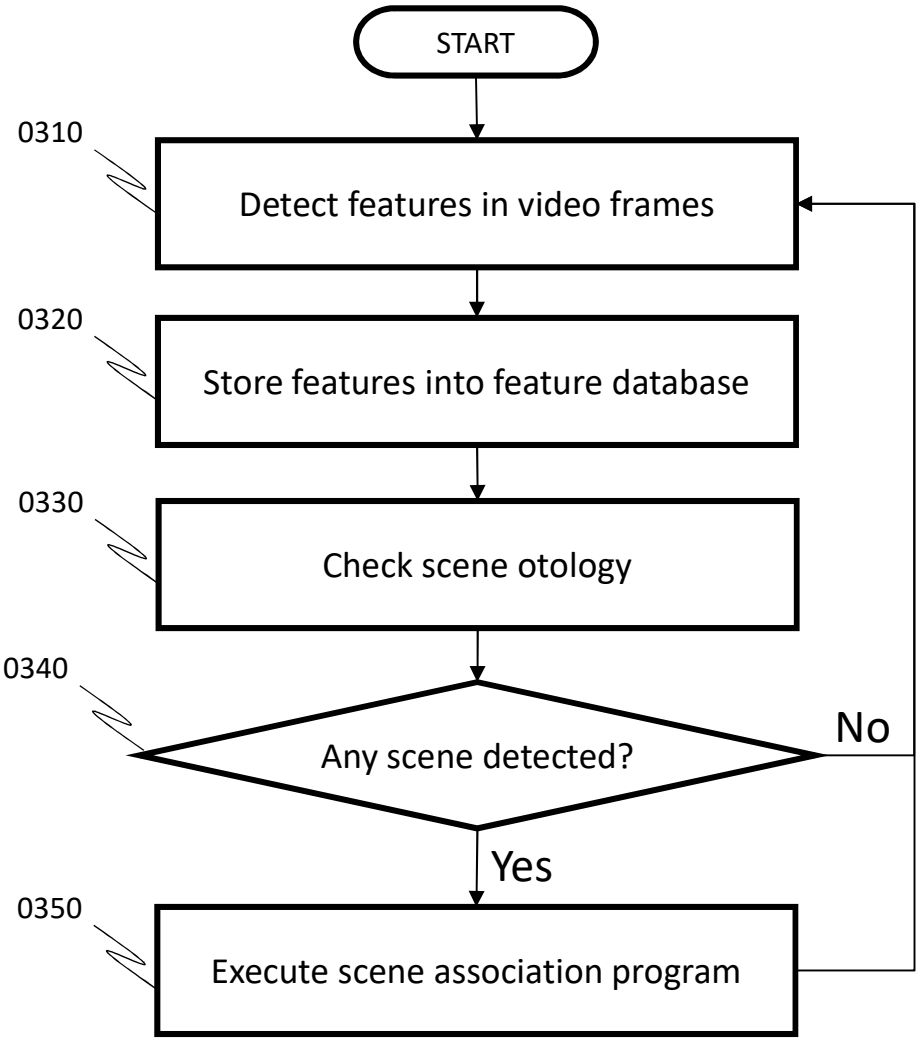

START
0310
Detect features in video frames
0320
Store features into feature database
0330
Check scene otology
0340
Any scene detected?
No
Yes
0350
Execute scene association program

FIG. 3

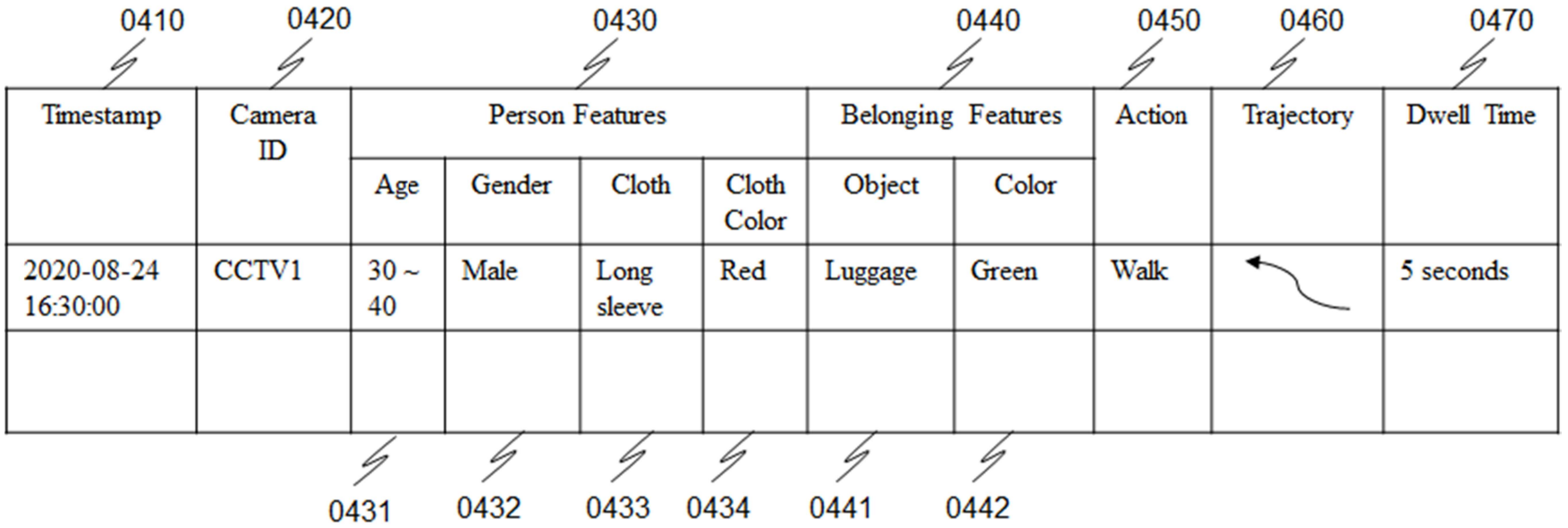

0410
0420
0430
0440
0450
0460
0470
Timestamp
Camera ID
Person Features
Belonging Features
Action
Trajectory
Dwell Time
Age
Gender
Cloth
Cloth Color
Object
Color
2020-08-24 16:30:00
CCTV1
30 ~ 40
Male
Long sleeve
Red
Luggage
Green
Walk
5 seconds
0431
0432
0433
0434
0441
0442

FIG. 4

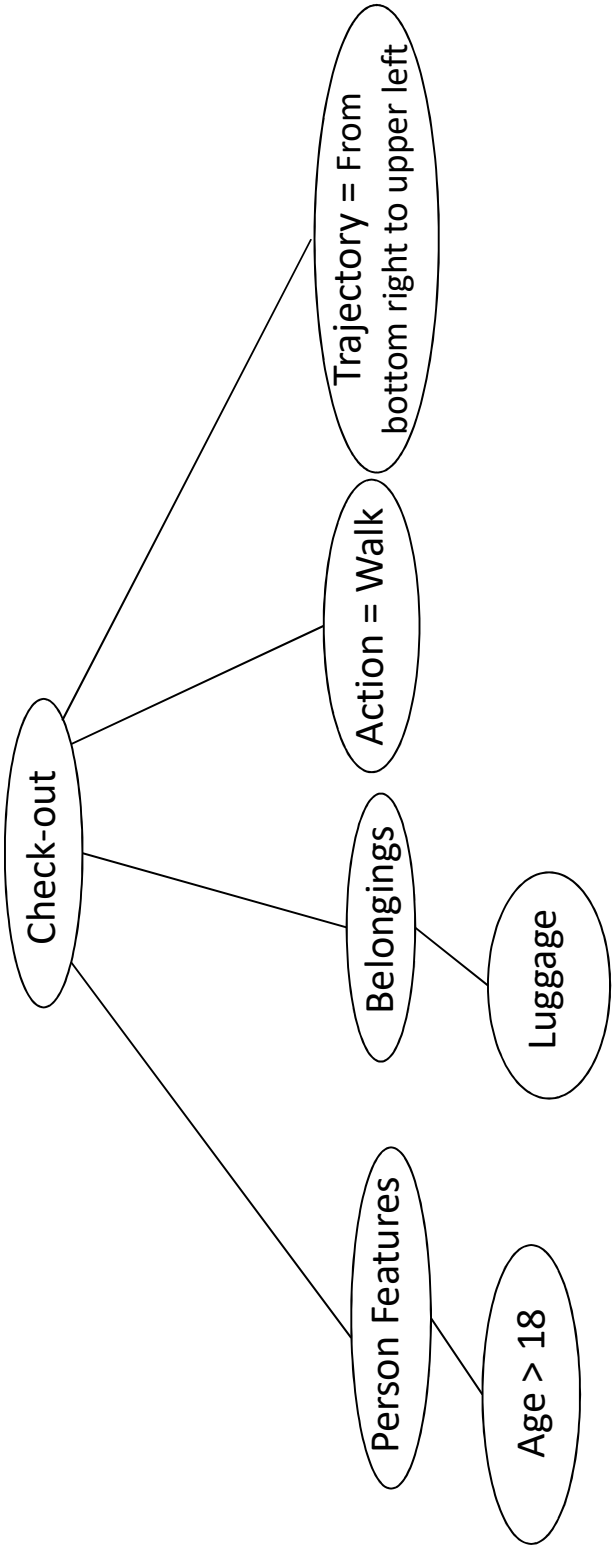

Check-out
Trajectory = From bottom right to upper left
Action = Walk
Belongings
Luggage
Person Features
Age > 18

FIG. 5

0610 Camera ID	0620 Scene Ontology	0630 Start Time	0640 End Time
CCTV1	Check-out	12:00:00	18:30:00
…	…	…	…

FIG. 6

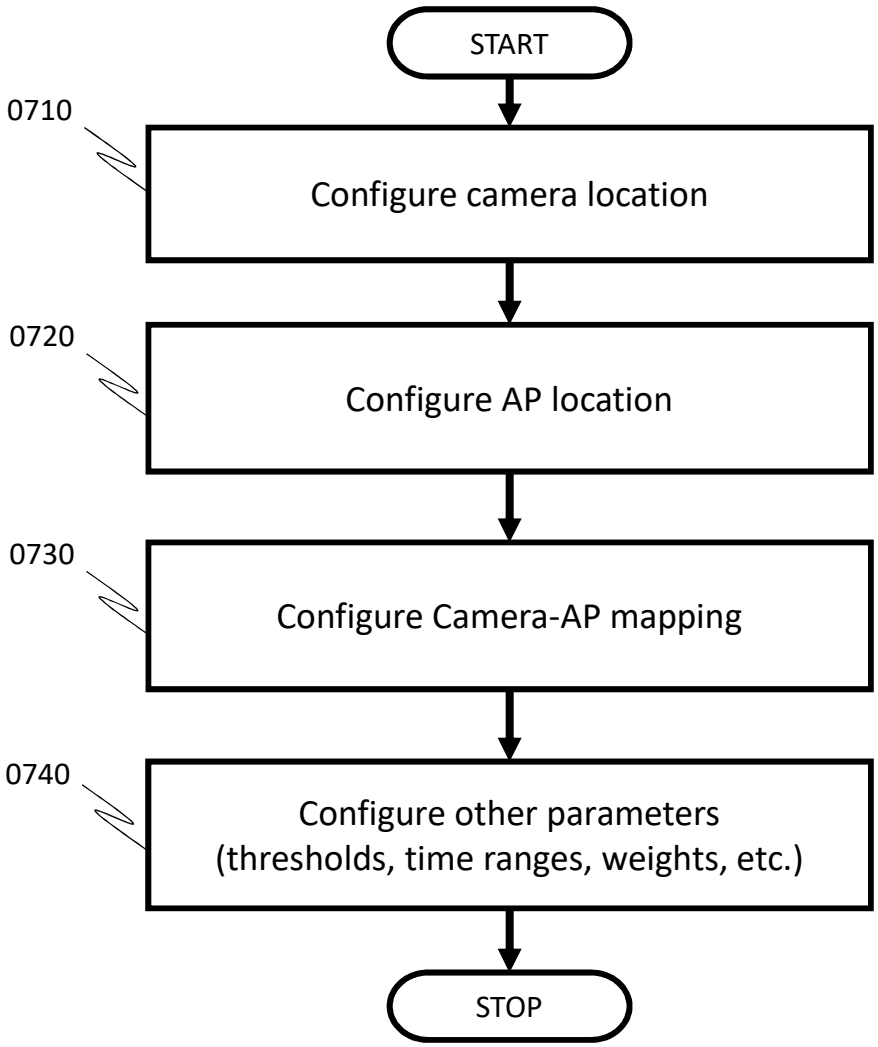
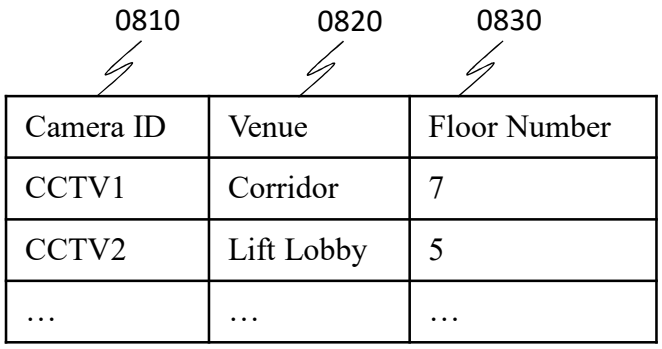
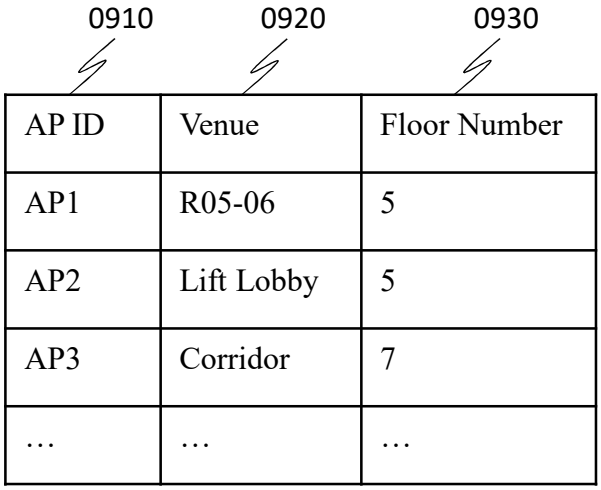


FIG. 7



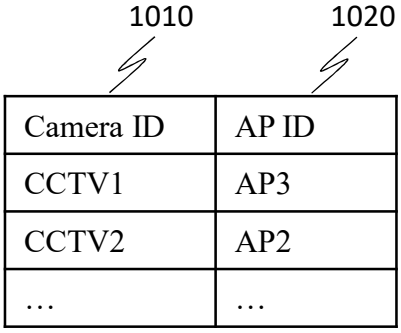
Camera ID	Venue	Floor Number
CCTV1	Corridor	7
CCTV2	Lift Lobby	5
…	…	…

FIG. 8



AP ID	Venue	Floor Number
AP1	R05-06	5
AP2	Lift Lobby	5
AP3	Corridor	7
…	…	…

FIG. 9



Camera ID	AP ID
CCTV1	AP3
CCTV2	AP2
…	…

FIG. 10

1110	1120	1130	1140
Connection Time	Phone ID	AP ID	Disconnection Time
2020-08-24 15:30:00	112233445566	AP1	2020-08-24 16:30:45
…	…	…	…

FIG. 11

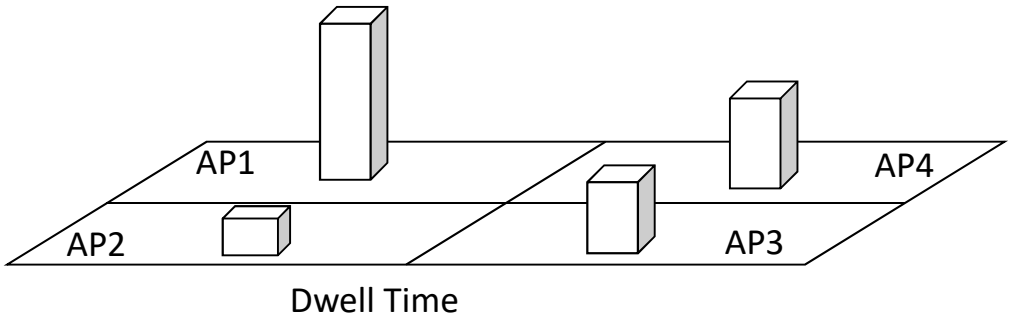


FIG. 12

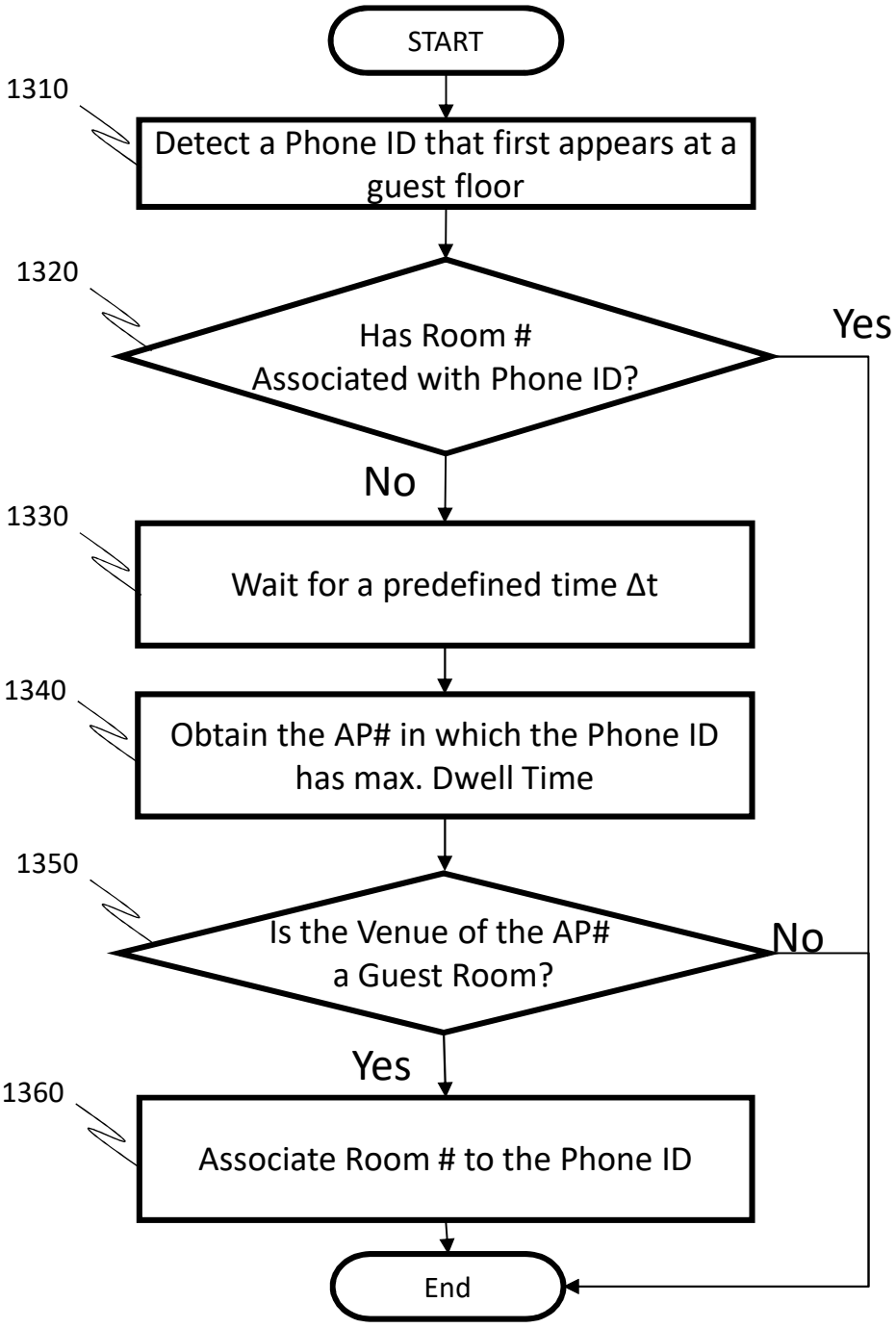

START
1310
Detect a Phone ID that first appears at a guest floor
1320
Has Room # Associated with Phone ID?
Yes
No
1330
Wait for a predefined time Δt
1340
Obtain the AP# in which the Phone ID has max. Dwell Time
1350
Is the Venue of the AP# a Guest Room?
No
Yes
1360
Associate Room # to the Phone ID
End

FIG. 13

1410 Phone ID	1420 Room number	1430 Floor number
112233445566	R05-06	5
…	…	…

FIG. 14

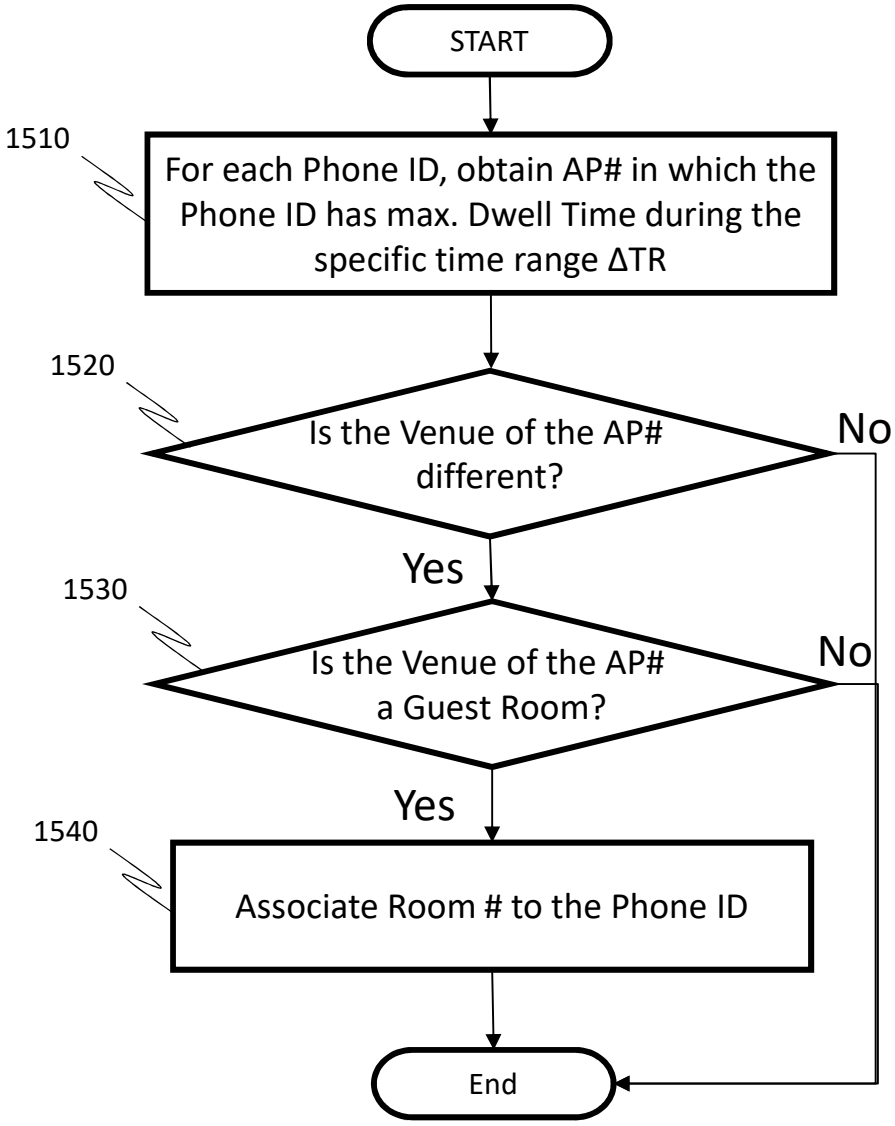


FIG. 15



FIG. 16A

1610 1620 1630

Source AP ID	Destination AP ID	Moving Time
AP1	AP2	60 seconds
…	…	…

FIG. 16B

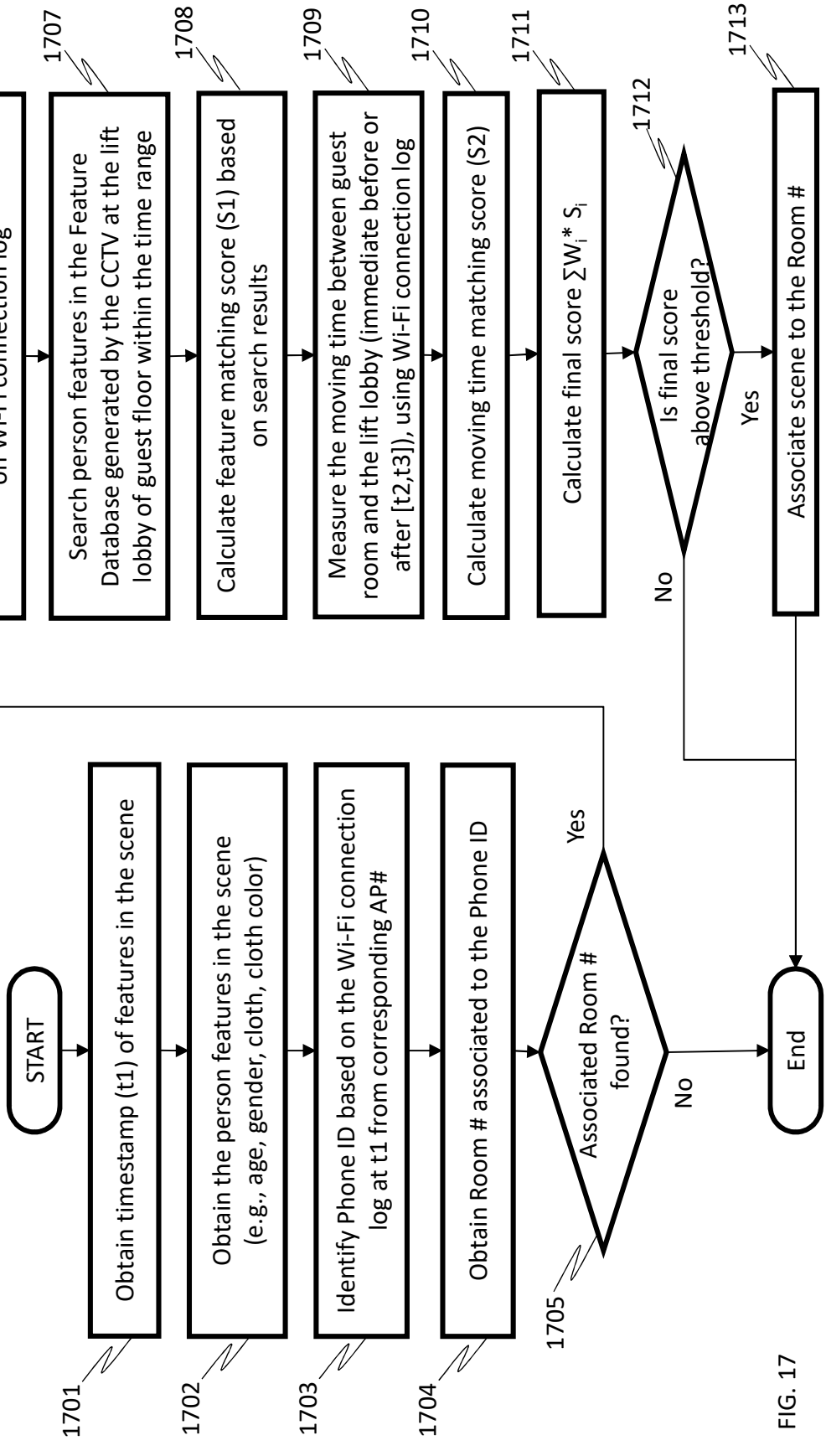

START
Obtain timestamp (t1) of features in the scene
Obtain the person features in the scene (e.g., age, gender, cloth, cloth color)
Identify Phone ID based on the Wi-Fi connection log at t1 from corresponding AP#
Obtain Room # associated to the Phone ID
Associated Room # found?
Yes
No
End
Obtain time range [t2,t3] when guest last appeared at the lift lobby of guest floor, based on Wi-Fi connection log
Search person features in the Feature Database generated by the CCTV at the lift lobby of guest floor within the time range
Calculate feature matching score (S1) based on search results
Measure the moving time between guest room and the lift lobby (immediate before or after [t2,t3]), using Wi-Fi connection log
Calculate moving time matching score (S2)
Calculate final score $\sum W_i * S_i$
Is final score above threshold?
Yes
No
Associate scene to the Room #
1701
1702
1703
1704
1705
1706
1707
1708
1709
1710
1711
1712
1713

FIG. 17

Scene	Action
Person with luggage moving towards elevator	1. Call elevator to the guest floor (____) 2. Inform front desk to start check-out process (____)
Cough	1. Send medicine or make a phone call to (____) to check if any help required
Don't know how to use equipment	1. Send staff to help guest from (____) at (____)
Sport	1. Provide sport related loyalty program to the guest from (____)

FIG. 18A

Scene	Action
Person with luggage moving towards elevator	1. Call elevator to the guest floor (**Room #**) 2. Inform front desk to start check-out process (**Room #**)
Cough	1. Send medicine or make a phone call to (**Room #**) to check if any help required
Don't know how to use equipment	1. Send staff to help guest from (**Room #**) at (**CCTV camera location**)
Sport	1. Provide sport related loyalty program to the guest from (**Room #**)

FIG. 18B