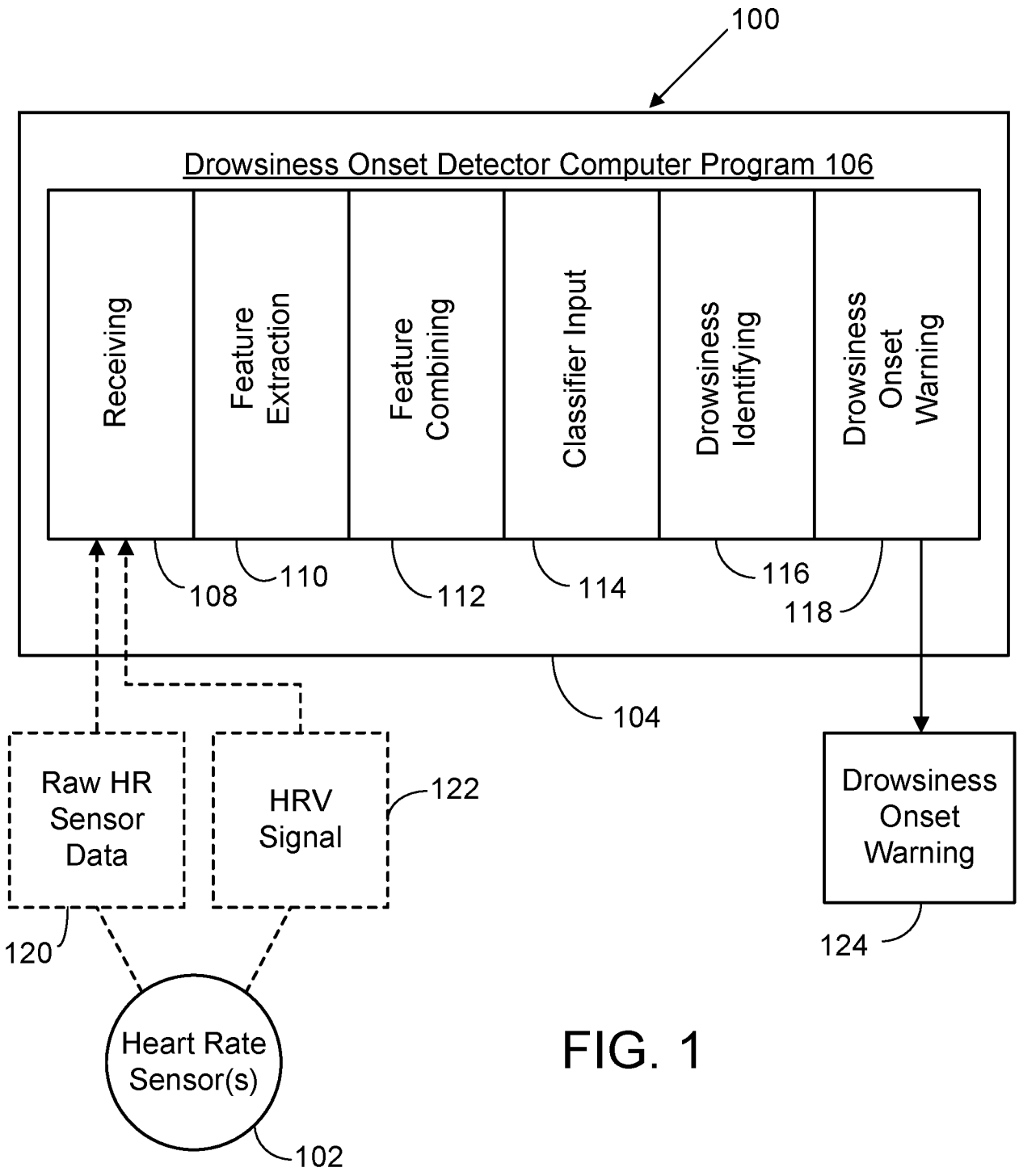
100
Drowsiness Onset Detector Computer Program 106
Receiving
Feature Extraction
Feature Combining
Classifier Input
Drowsiness Identifying
Drowsiness Onset Warning
108
110
112
114
116
118
104
Raw HR Sensor Data
HRV Signal
122
120
Heart Rate Sensor(s)
102
Drowsiness Onset Warning
124

FIG. 1

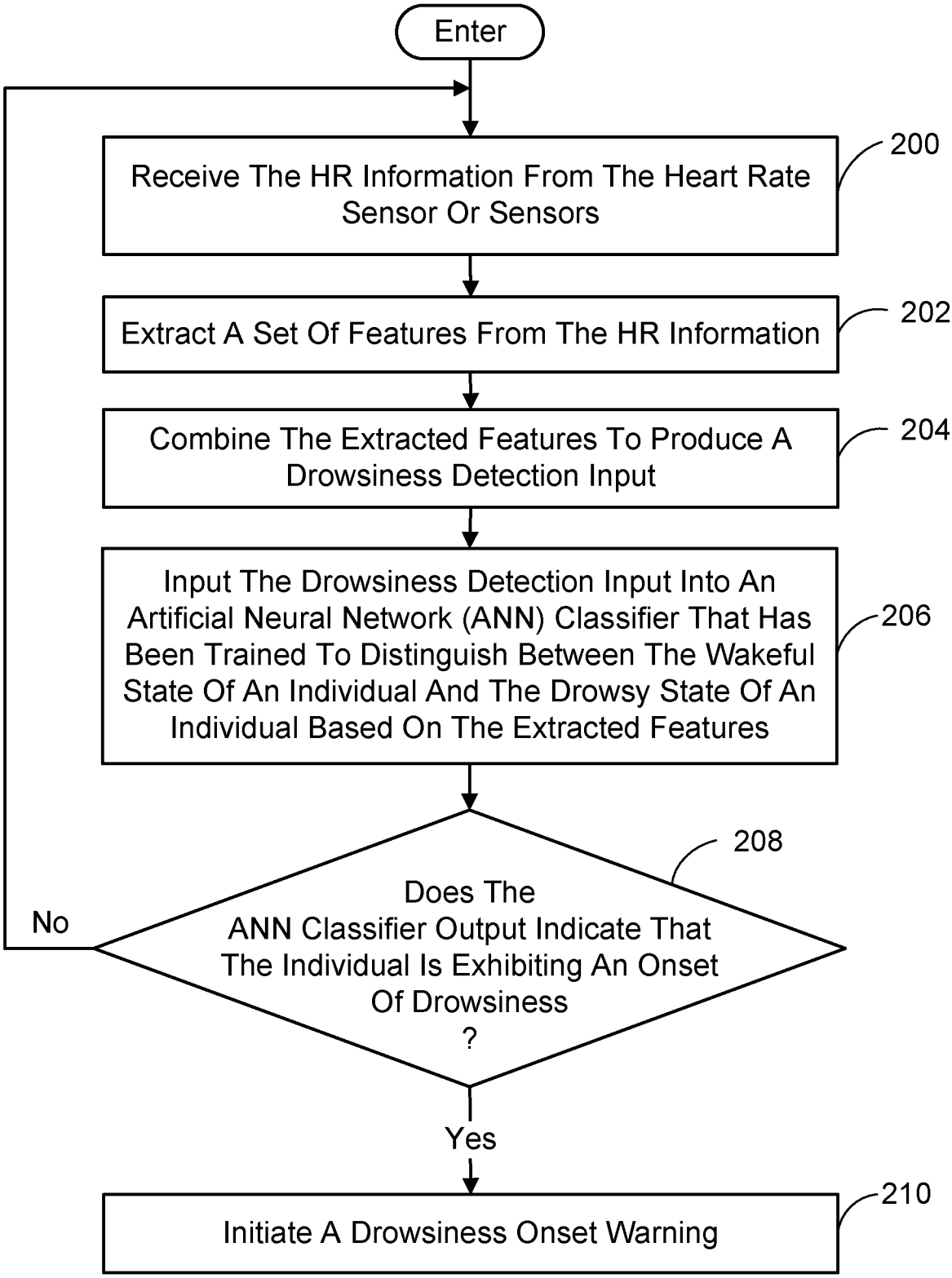
Enter
Receive The HR Information From The Heart Rate Sensor Or Sensors
200
Extract A Set Of Features From The HR Information
202
Combine The Extracted Features To Produce A Drowsiness Detection Input
204
Input The Drowsiness Detection Input Into An Artificial Neural Network (ANN) Classifier That Has Been Trained To Distinguish Between The Wakeful State Of An Individual And The Drowsy State Of An Individual Based On The Extracted Features
206
208
Does The ANN Classifier Output Indicate That The Individual Is Exhibiting An Onset Of Drowsiness ?
No
Yes
Initiate A Drowsiness Onset Warning
210

FIG. 2

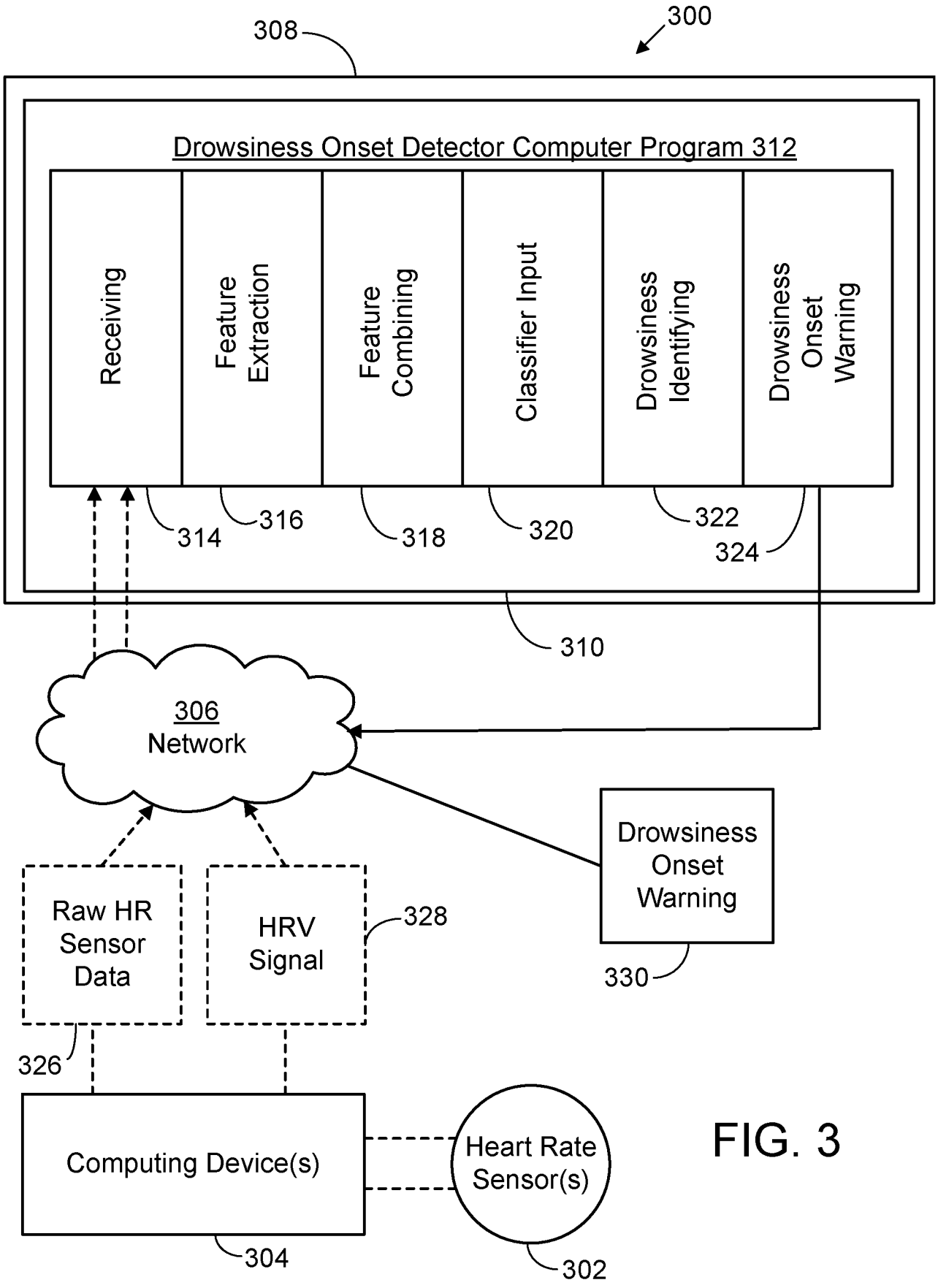
308
300
Drowsiness Onset Detector Computer Program 312
Receiving
Feature Extraction
Feature Combining
Classifier Input
Drowsiness Identifying
Drowsiness Onset Warning
314
316
318
320
322
324
310
306
Network
Drowsiness Onset Warning
330
Raw HR Sensor Data
HRV Signal
328
326
Computing Device(s)
Heart Rate Sensor(s)
304
302

FIG. 3

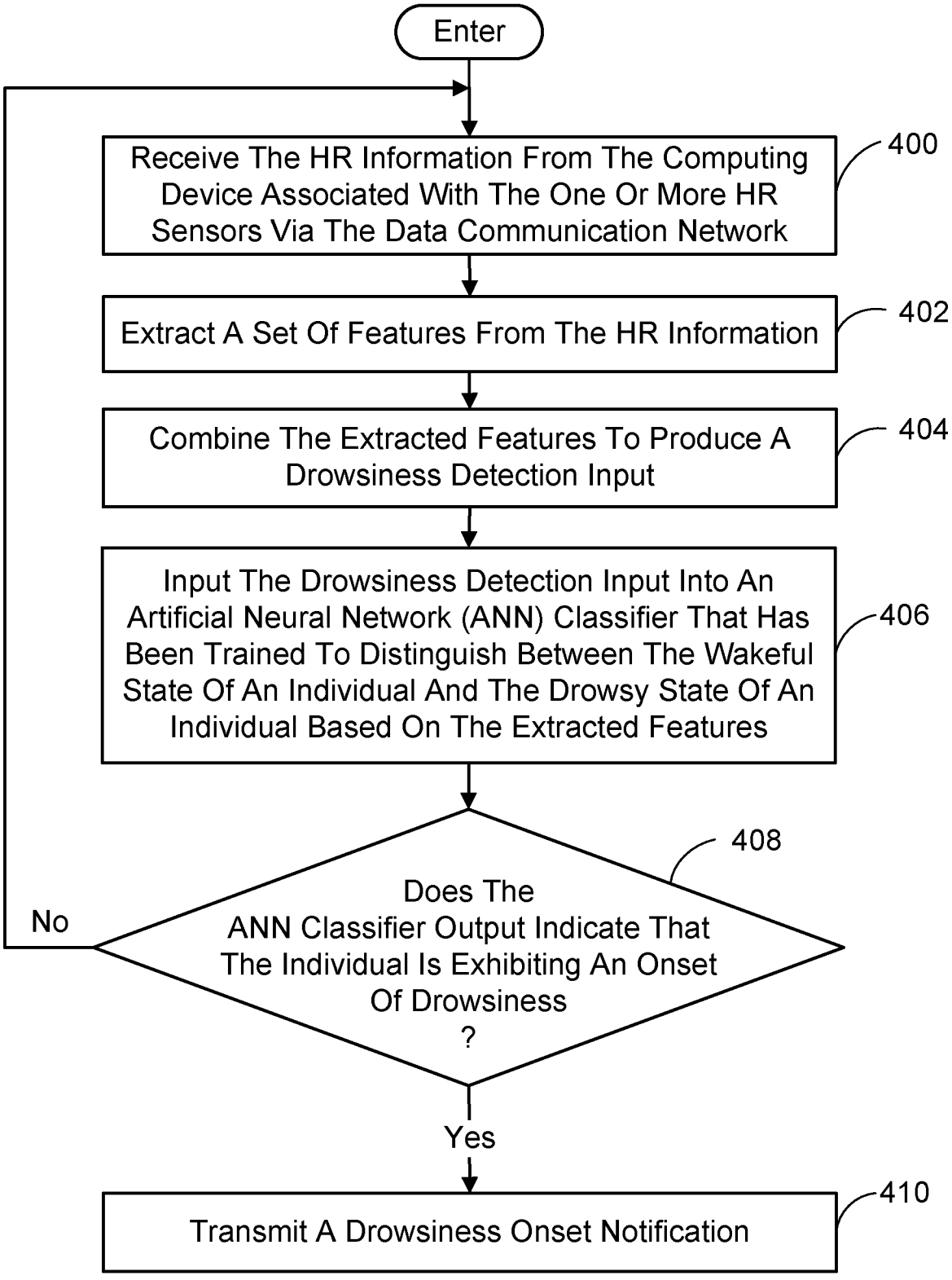
Enter
Receive The HR Information From The Computing Device Associated With The One Or More HR Sensors Via The Data Communication Network
400
Extract A Set Of Features From The HR Information
402
Combine The Extracted Features To Produce A Drowsiness Detection Input
404
Input The Drowsiness Detection Input Into An Artificial Neural Network (ANN) Classifier That Has Been Trained To Distinguish Between The Wakeful State Of An Individual And The Drowsy State Of An Individual Based On The Extracted Features
406
Does The ANN Classifier Output Indicate That The Individual Is Exhibiting An Onset Of Drowsiness ?
408
No
Yes
Transmit A Drowsiness Onset Notification
410

FIG. 4

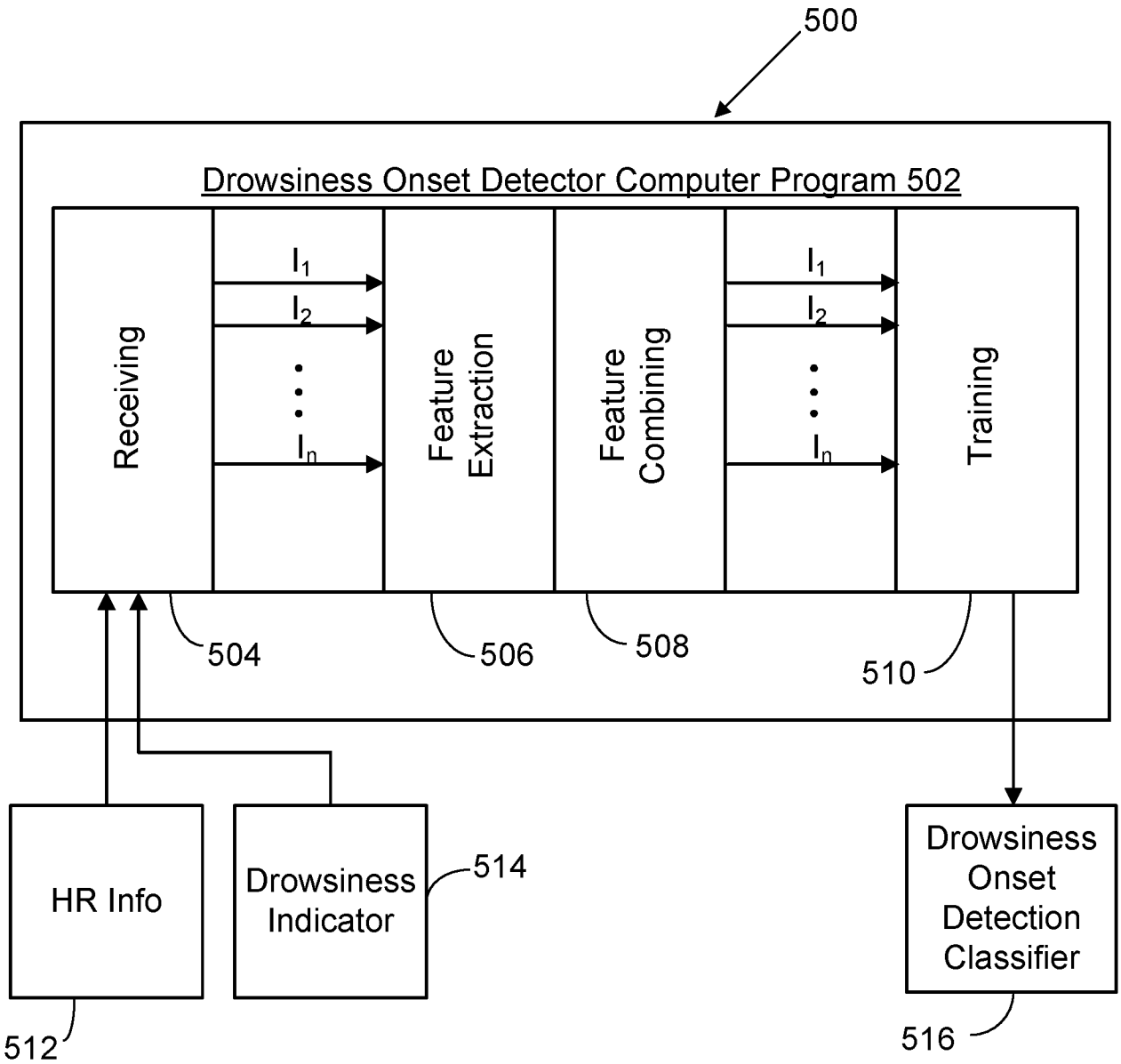
500
Drowsiness Onset Detector Computer Program 502
Receiving
I_1
I_2
I_n
Feature Extraction
Feature Combining
I_1
I_2
I_n
Training
504
506
508
510
HR Info
Drowsiness Indicator
514
Drowsiness Onset Detection Classifier
512
516

FIG. 5

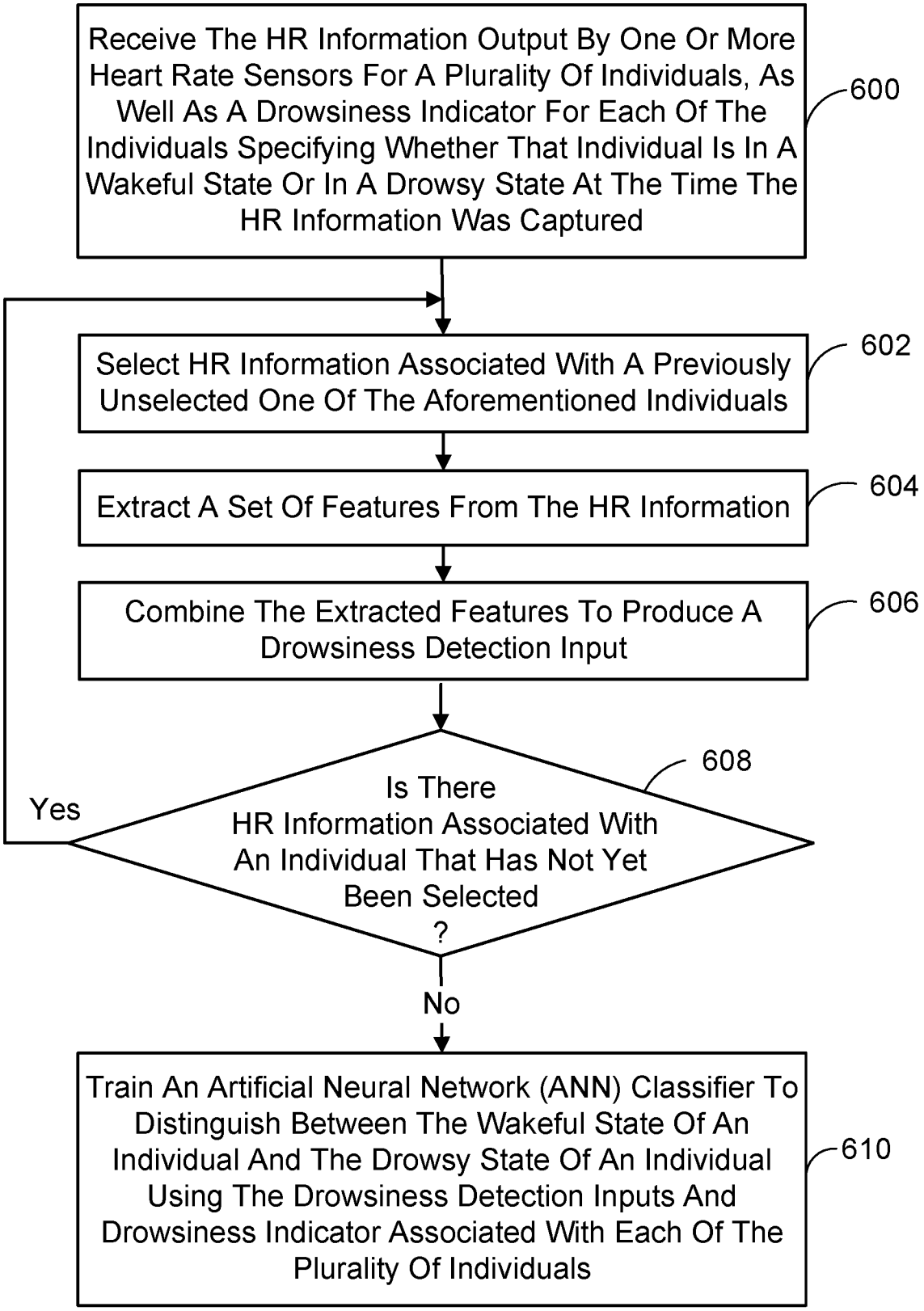
Receive The HR Information Output By One Or More Heart Rate Sensors For A Plurality Of Individuals, As Well As A Drowsiness Indicator For Each Of The Individuals Specifying Whether That Individual Is In A Wakeful State Or In A Drowsy State At The Time The HR Information Was Captured
600
Select HR Information Associated With A Previously Unselected One Of The Aforementioned Individuals
602
Extract A Set Of Features From The HR Information
604
Combine The Extracted Features To Produce A Drowsiness Detection Input
606
Is There HR Information Associated With An Individual That Has Not Yet Been Selected ?
608
Yes
No
Train An Artificial Neural Network (ANN) Classifier To Distinguish Between The Wakeful State Of An Individual And The Drowsy State Of An Individual Using The Drowsiness Detection Inputs And Drowsiness Indicator Associated With Each Of The Plurality Of Individuals
610

FIG. 6

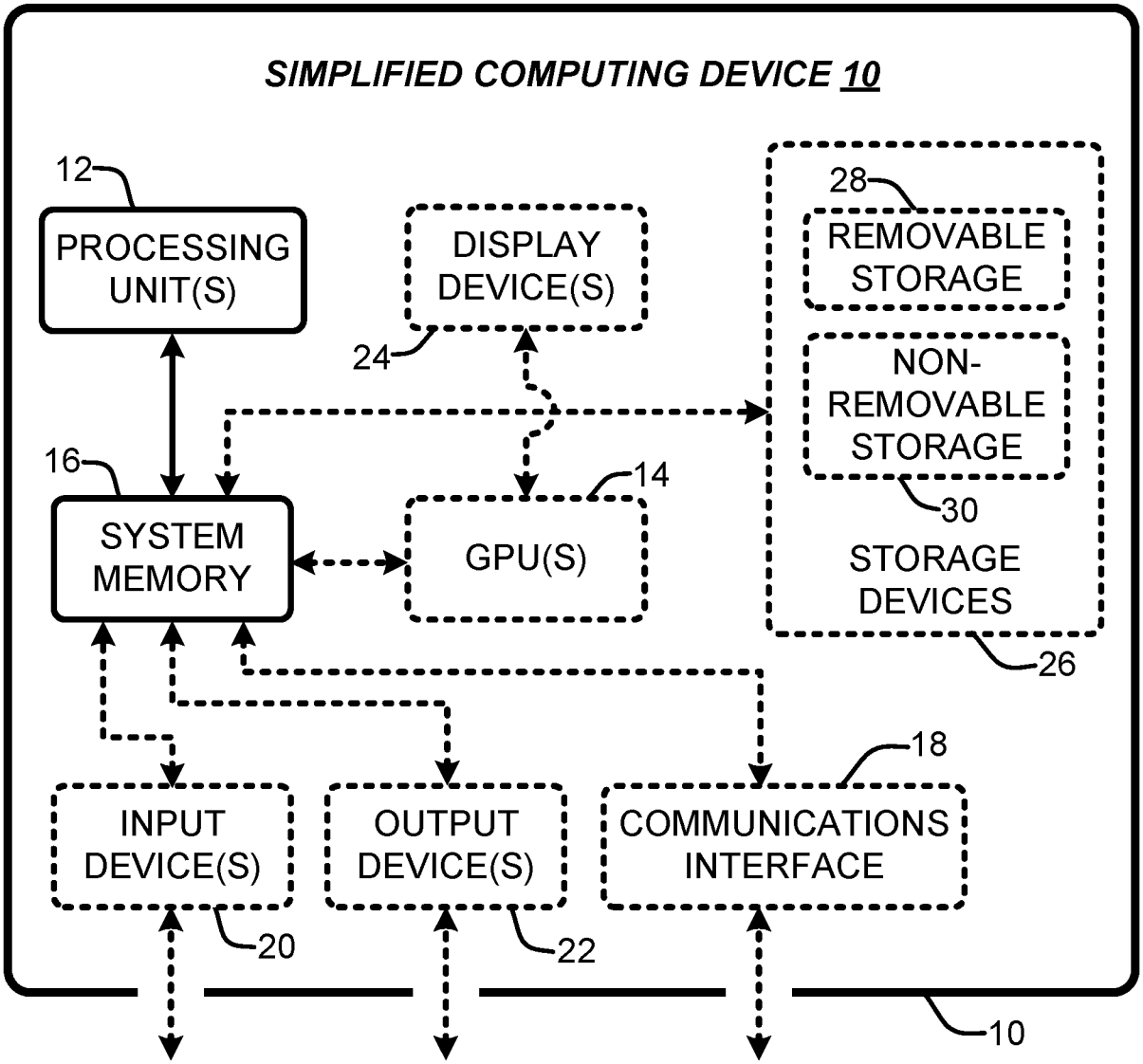
SIMPLIFIED COMPUTING DEVICE 10
12
PROCESSING UNIT(S)
DISPLAY DEVICE(S)
24
28
REMOVABLE STORAGE
NON-REMOVABLE STORAGE
30
STORAGE DEVICES
26
16
SYSTEM MEMORY
GPU(S)
14
INPUT DEVICE(S)
20
OUTPUT DEVICE(S)
22
18
COMMUNICATIONS INTERFACE
10

FIG. 7