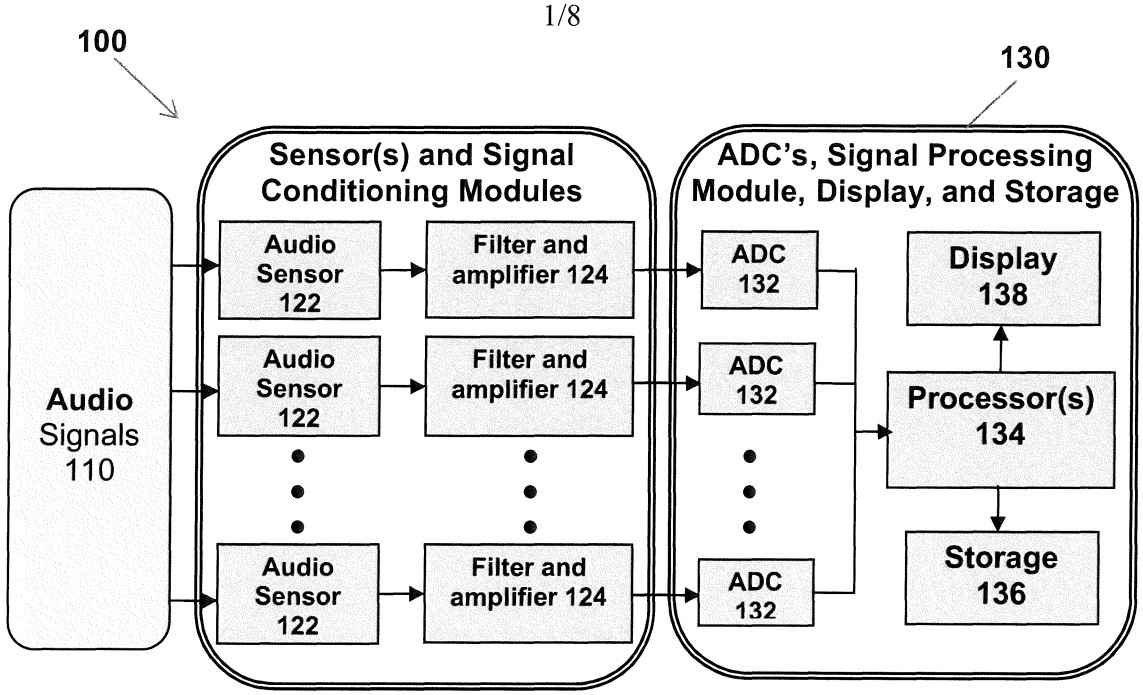
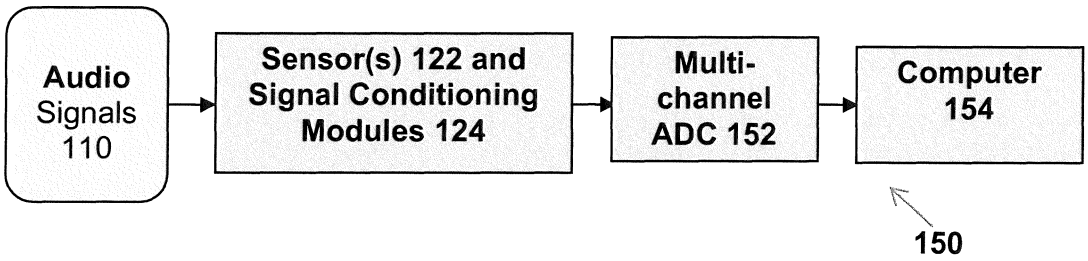
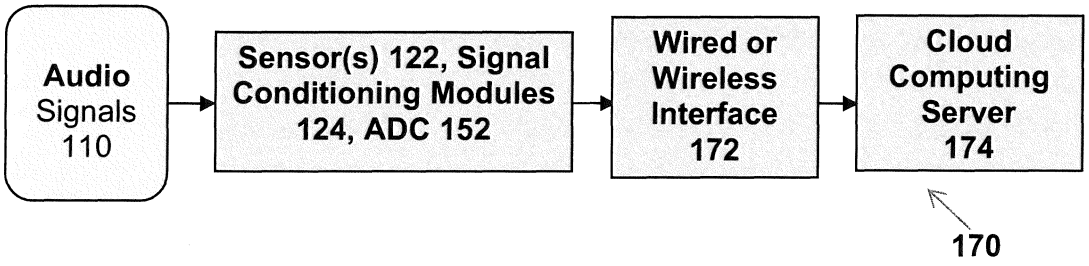


(a) Portable device configuration



(b) Sensor-computer configuration



(c) Sensor-cloud computing configuration

Figure 1

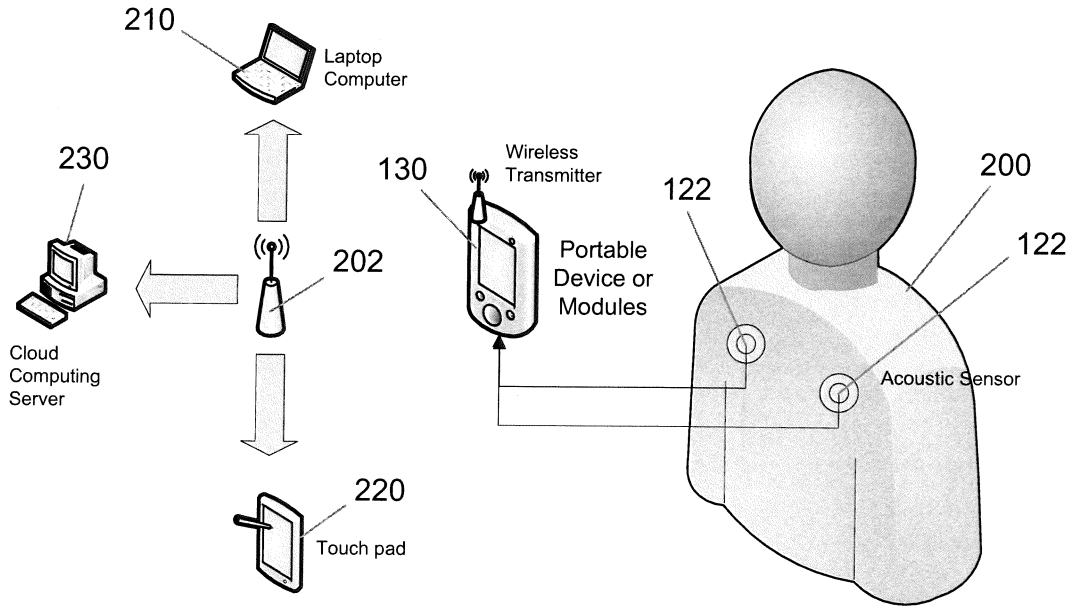

210
Laptop
Computer
230
Cloud
Computing
Server
202
130
Wireless
Transmitter
Portable
Device or
Modules
220
Touch pad
200
122
122
Acoustic Sensor

Figure 2

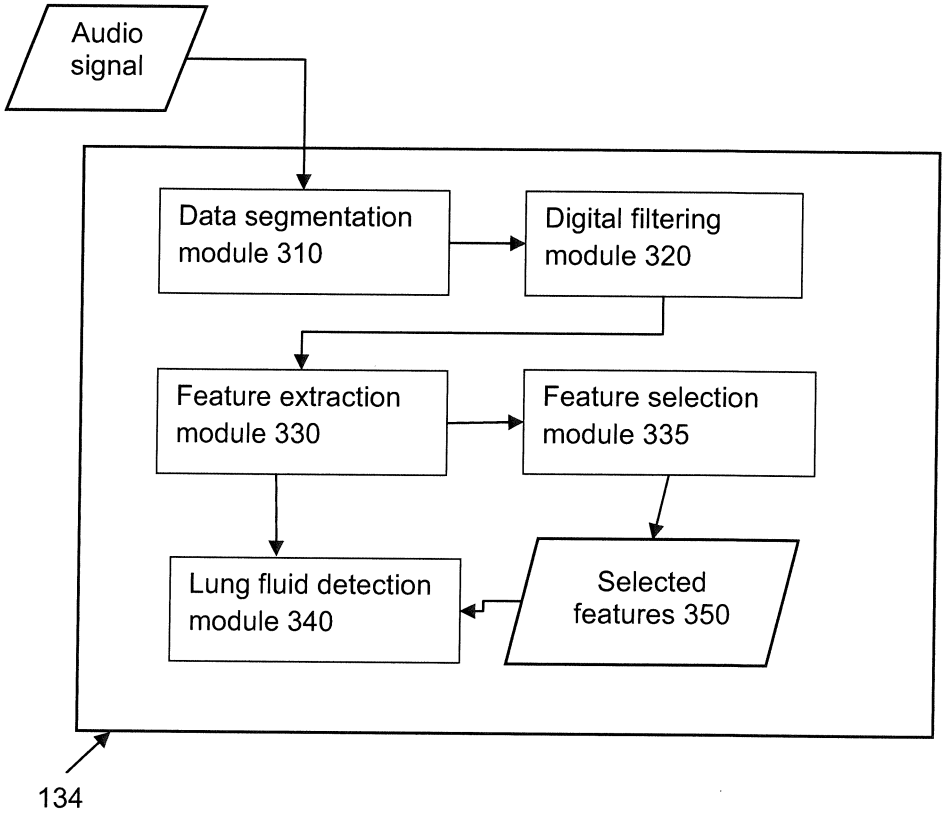

Audio signal
Data segmentation module 310
Digital filtering module 320
Feature extraction module 330
Feature selection module 335
Lung fluid detection module 340
Selected features 350
134

Figure 3

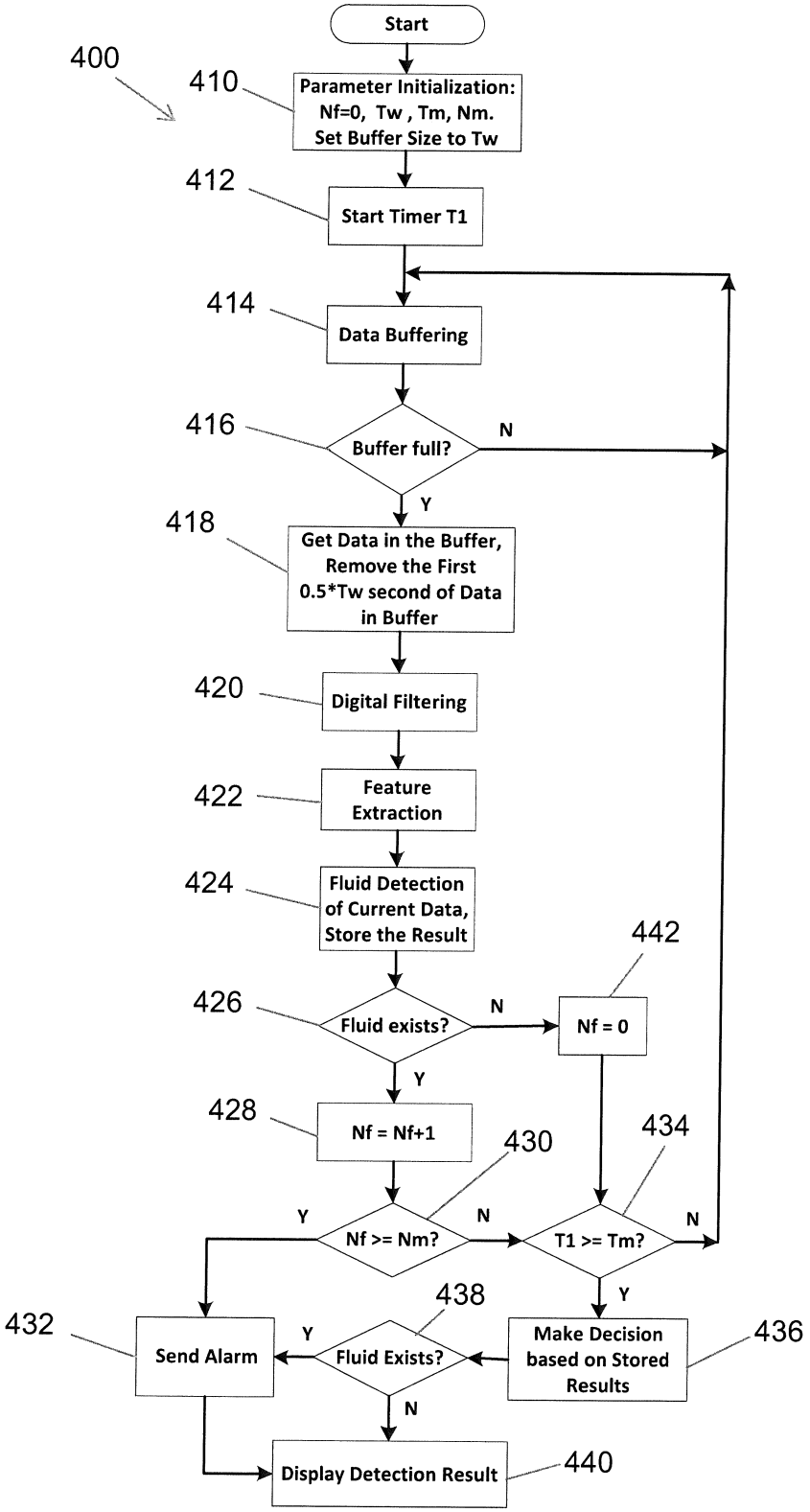

Start
400
410
Parameter Initialization: Nf=0, Tw , Tm, Nm. Set Buffer Size to Tw
412
Start Timer T1
414
Data Buffering
416
Buffer full?
N
Y
418
Get Data in the Buffer, Remove the First 0.5*Tw second of Data in Buffer
420
Digital Filtering
422
Feature Extraction
424
Fluid Detection of Current Data, Store the Result
442
426
Fluid exists?
N
Nf = 0
Y
428
Nf = Nf+1
430
434
Y
Nf >= Nm?
N
T1 >= Tm?
N
Y
438
432
Send Alarm
Y
Fluid Exists?
Make Decision based on Stored Results
436
N
Display Detection Result
440

Figure 4

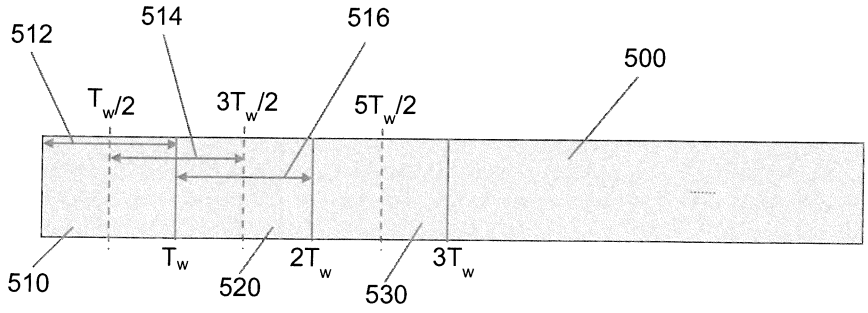


Figure 5

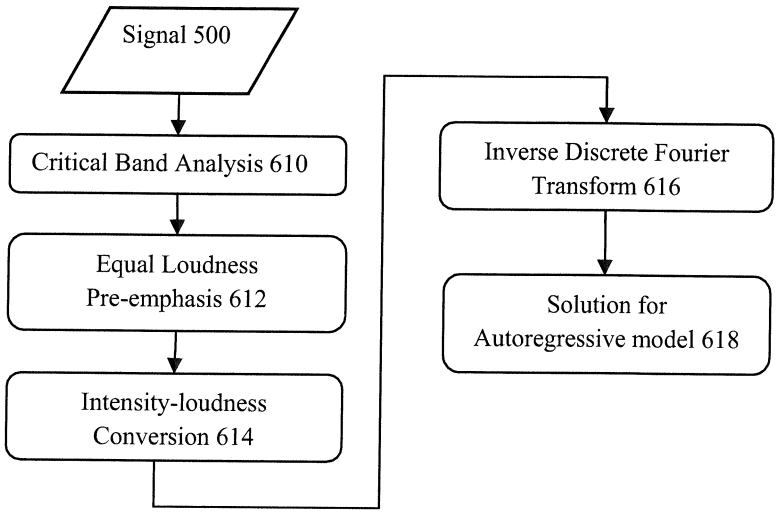

Signal 500
Critical Band Analysis 610
Equal Loudness Pre-emphasis 612
Intensity-loudness Conversion 614
Inverse Discrete Fourier Transform 616
Solution for Autoregressive model 618

Figure 6

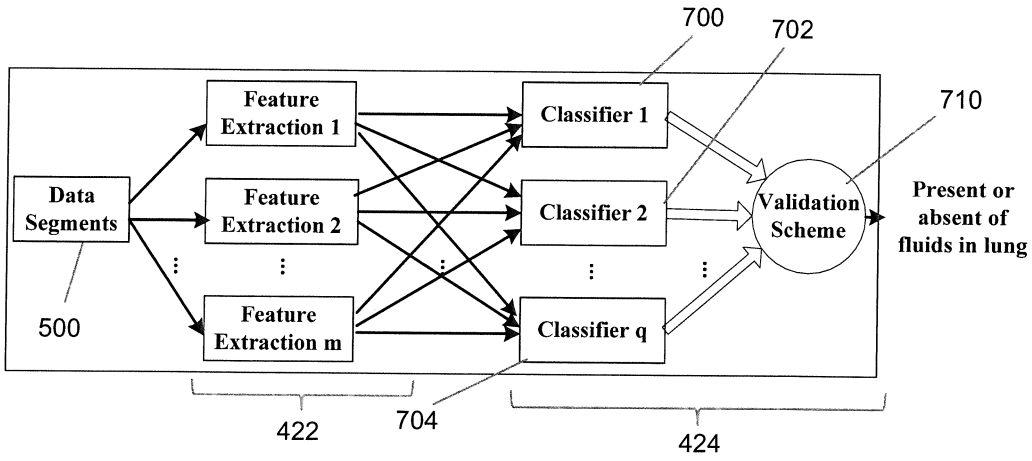
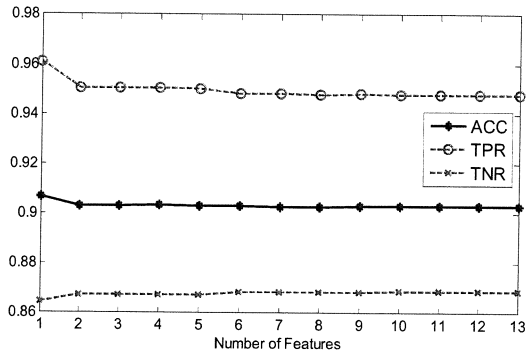
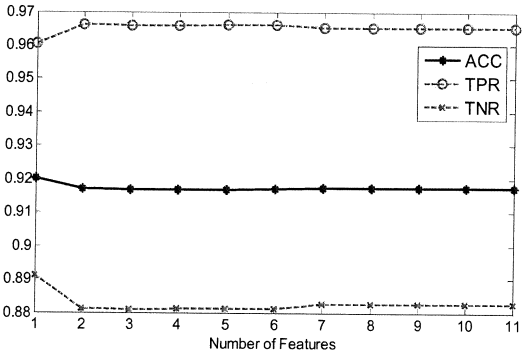

700
702
710
Feature Extraction 1
Feature Extraction 2
Feature Extraction m
Classifier 1
Classifier 2
Classifier q
Data Segments
Validation Scheme
Present or absent of fluids in lung
500
422
704
424

Figure 7



(a) MFCC + Classifier



(b) PLPC + Classifier

Figure 8