

voiceprint model is used to verify whether an input speech signal belongs to the target user.

18. The non-volatile computer readable storage medium according to claim 17, wherein the deep learning model comprises a plurality of model layers, and the step of inputting the plurality of speech acoustic features into a deep learning model that is based on neural network training, and collecting the plurality of speech acoustic features to form at least one cluster structure comprises:

inputting the plurality of speech acoustic features into the deep learning model;

selecting any time node t of the plurality of speech acoustic features, and establishing a n -th model layer with the plurality of speech acoustic features in every t_n time from the time node t , wherein n is a positive integer; and

selecting a target model layer in the plurality of model layers and obtaining at least one cluster structure generated at the target model layer.

19. The non-volatile computer readable storage medium according to claim 17, wherein the step of inputting the feature vector and an identity verification result of the target user into a preset basic model to obtain a voiceprint model corresponding to the target user comprises:

reducing dimensions of the feature vector of the voiceprint model; and

inputting the dimension-reduced feature vector and the identity verification result of the target user into the preset basic model to obtain the voiceprint model.

20. The non-volatile computer readable storage medium according to claim 17, wherein the step of extracting the plurality of speech acoustic features of the framed speech signal comprises:

performing fast Fourier transform on the framed speech signal to obtain an energy spectrum;

inputting the energy spectrum into a Mel-scaled triangular filter bank to output a plurality of formant features; and

performing discrete cosine transform on the formant features to obtain the plurality of speech acoustic features.

DRAWINGS

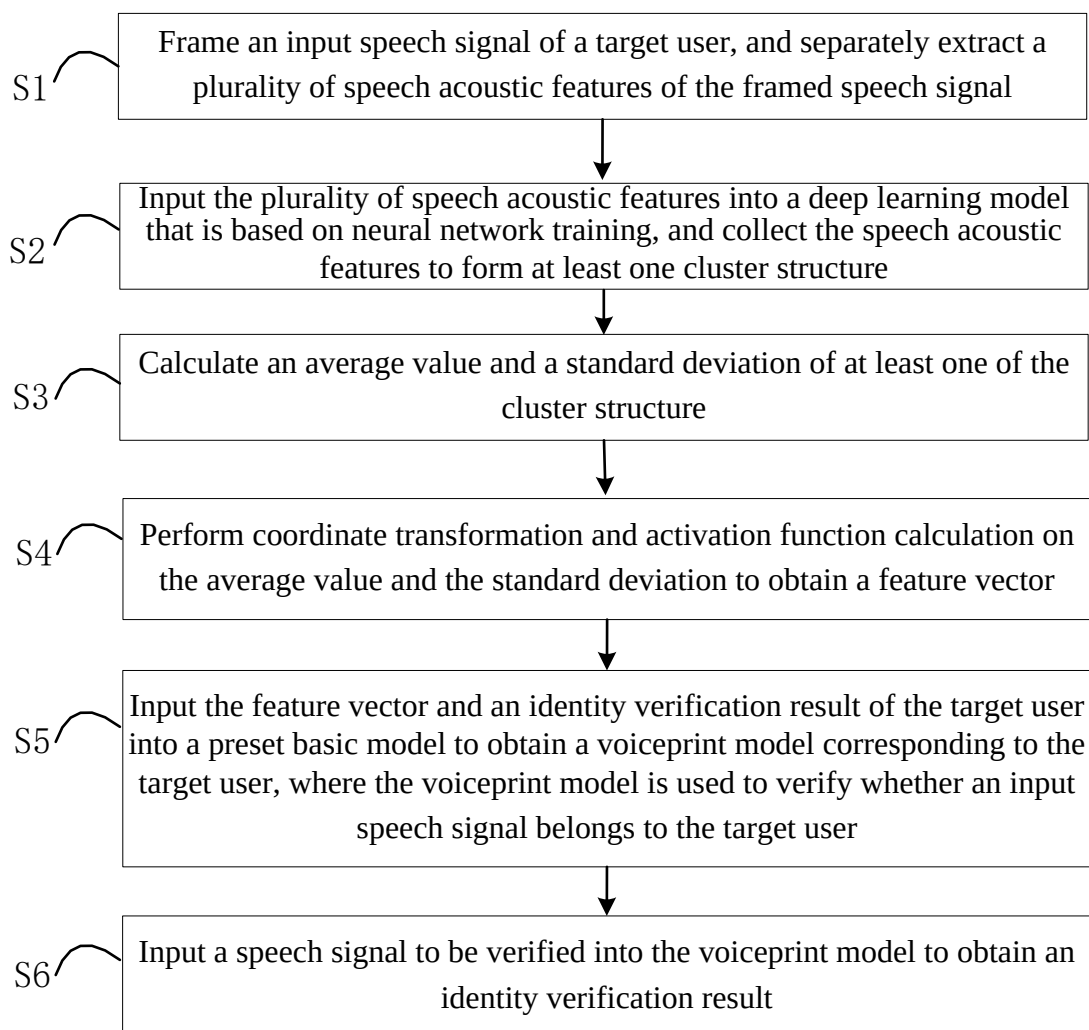


FIG. 1

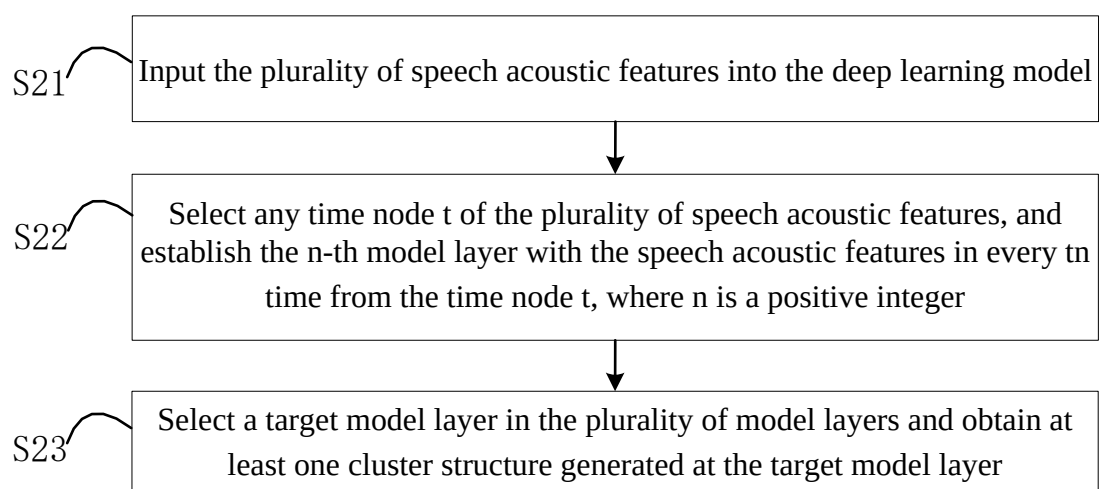


FIG. 2

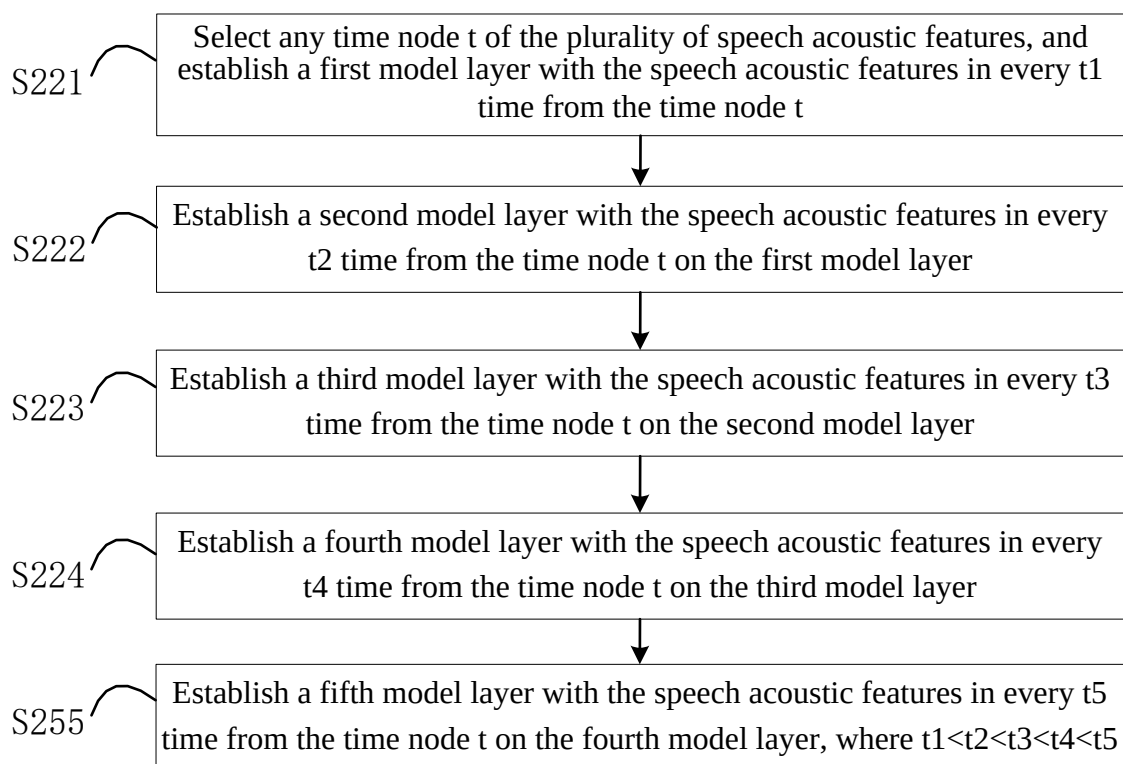


FIG. 3

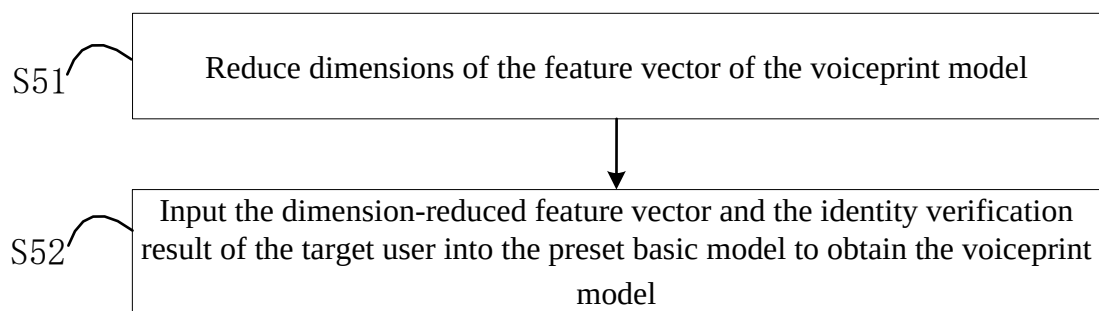


FIG. 4

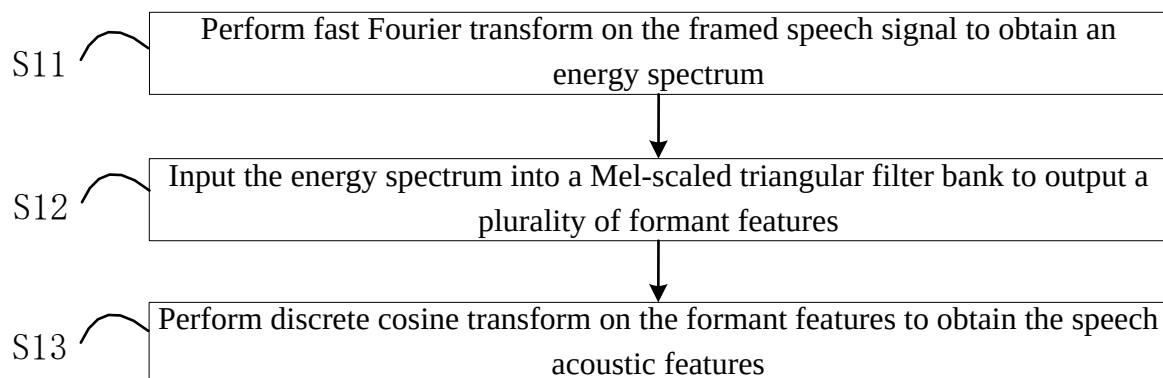


FIG. 5

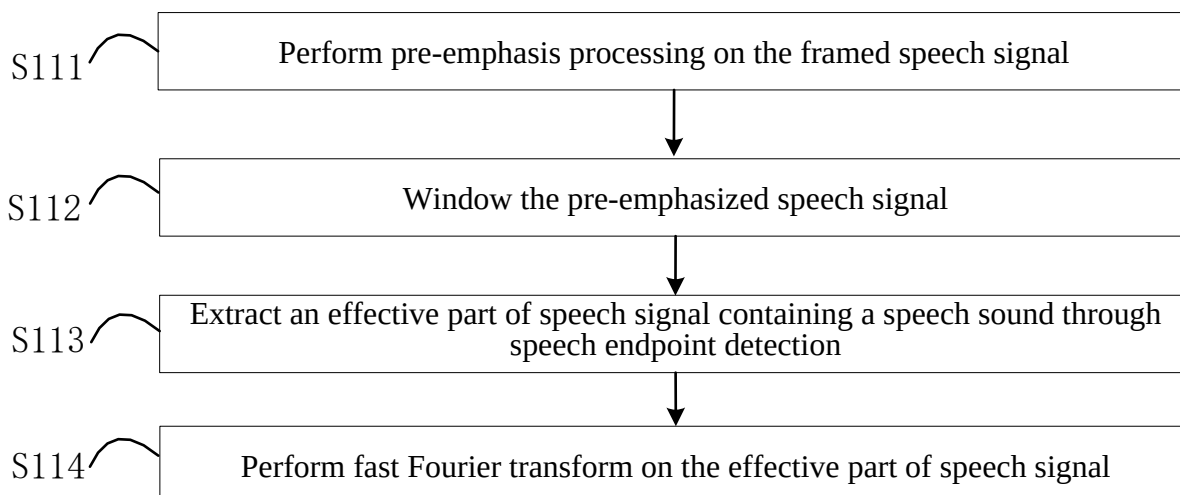


FIG. 6

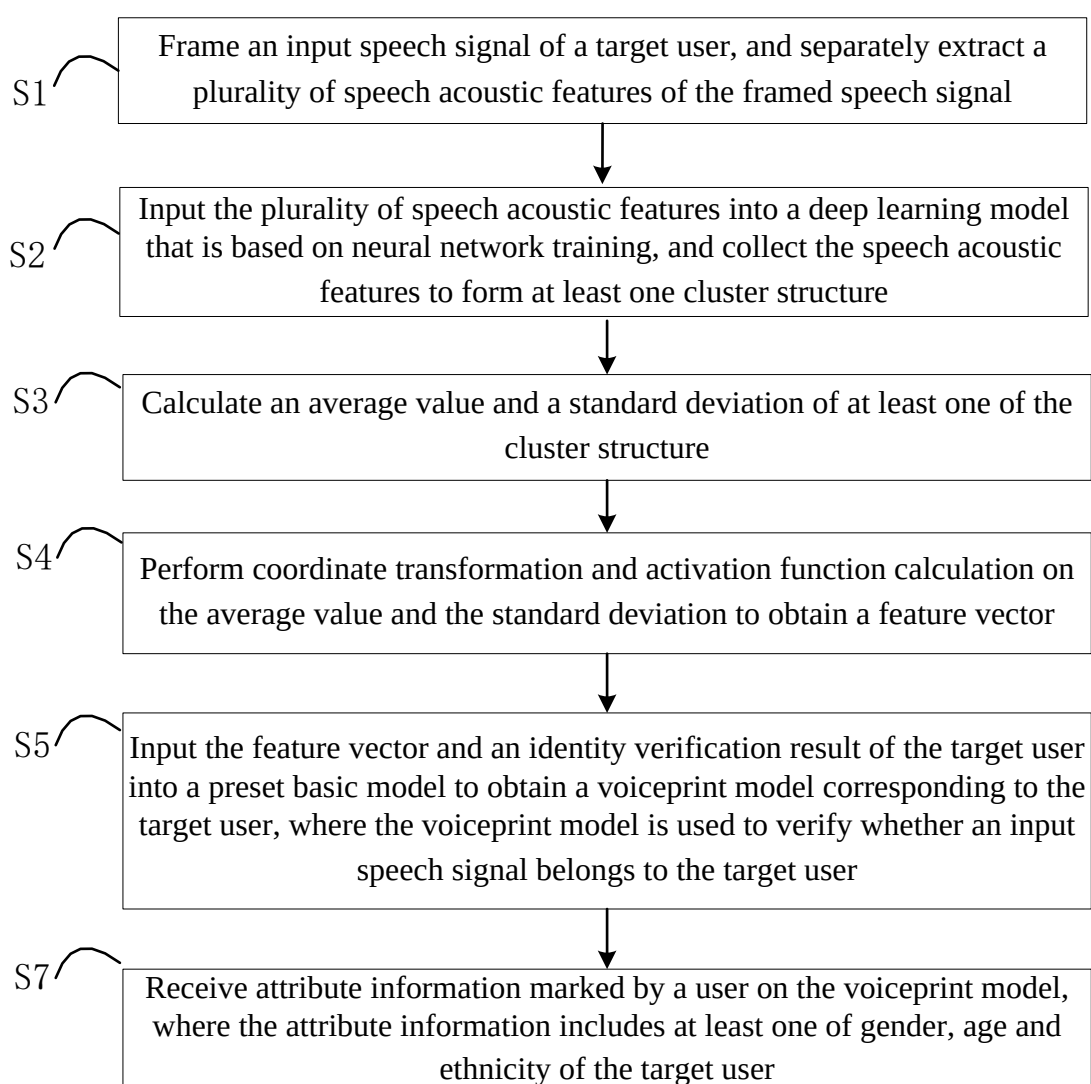


FIG. 7

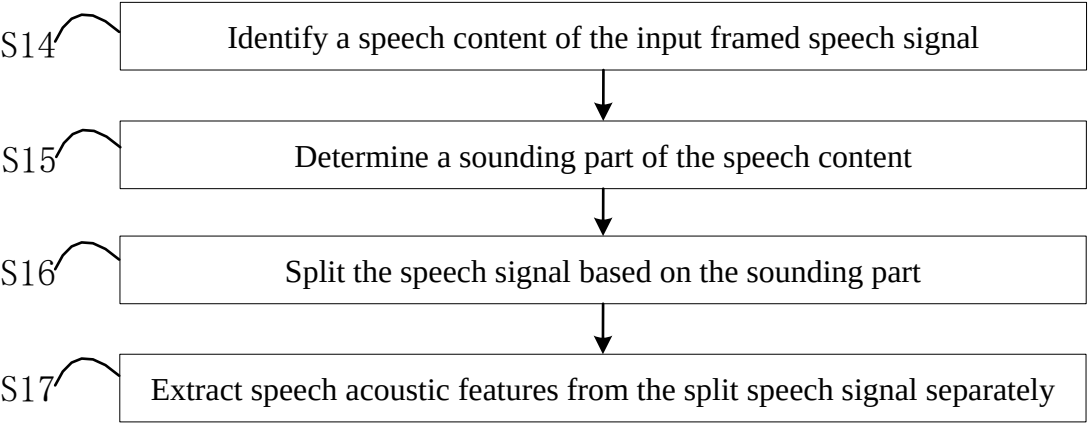


FIG. 8

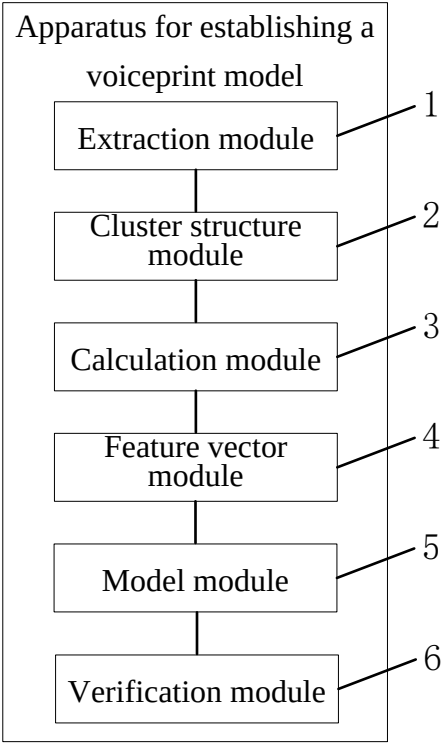


FIG. 9

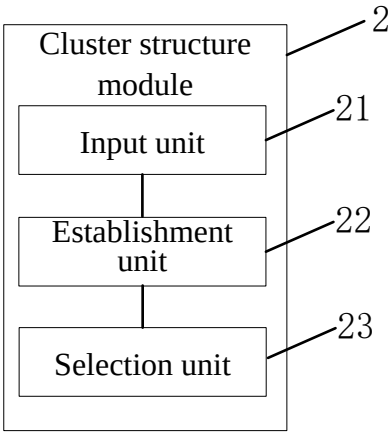


FIG. 10

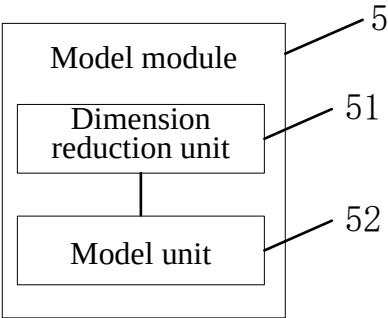


FIG. 11

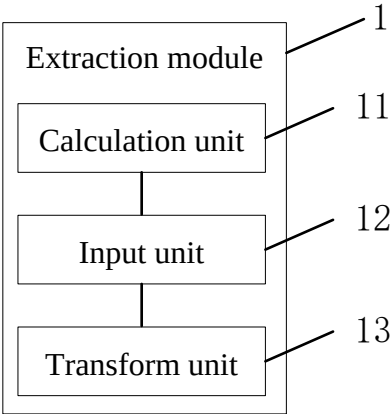


FIG. 12

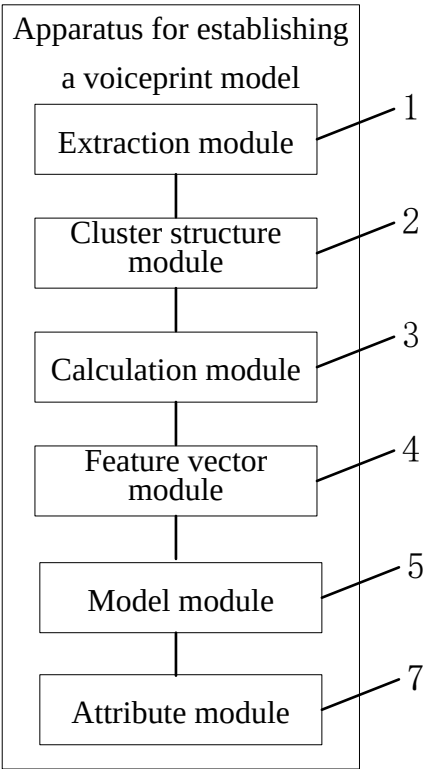


FIG. 13

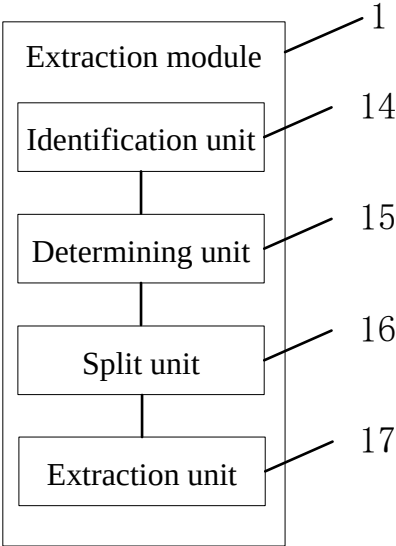


FIG. 14

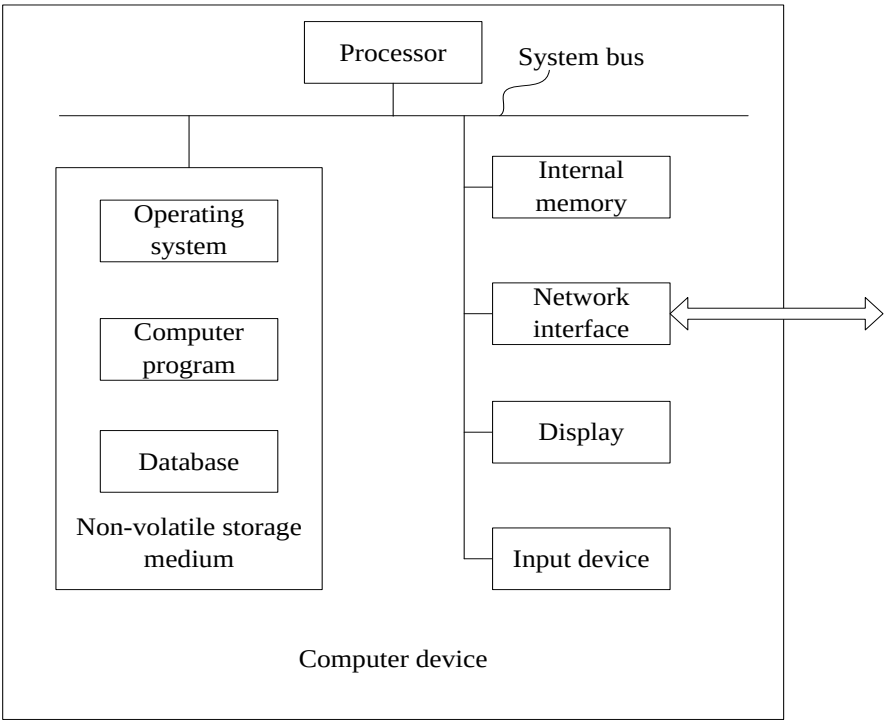


FIG. 15