受験番号：32IPE007

問１.

1. A cardiothoracic ratio calculation device for calculating a cardiothoracic ratio based on a chest X-ray image, the cardiothoracic ratio calculation device comprising:

a measurement position estimating unit configured to estimate a lung right edge position, a lung left edge position, a heart right edge position, and a heart left edge position in the chest X-ray image; and

a cardiothoracic ratio calculating unit configured to calculate the cardiothoracic ratio based on the estimated lung right edge position, lung left edge position, heart right edge position, and heart left edge position, wherein

the measurement position estimating unit divides the chest X-ray image into a plurality of transverse regions and, for each of the plurality of transverse regions, detects a lung right edge candidate and a lung left edge candidate based on a pixel value and detects a heart right edge candidate and a heart left edge candidate based on a horizontal-directional derivative of a pixel value,

the measurement position estimating unit further extracting a particular transverse region of the plurality of transverse regions based on a distance between a lung intermediate point defined by the lung right edge candidate and the lung left edge candidate and a heart intermediate point defined by the heart right edge candidate and the heart left edge candidate, or a ratio of the distance to a lung width defined by the lung right edge candidate and the lung left edge candidate, and estimating the lung right edge candidate, the lung left edge candidate, the heart right edge candidate, and the heart left edge candidate in the extracted particular transverse region as the lung right edge position, the lung left edge position, the heart right edge position, and the heart left edge position, respectively.

2. The cardiothoracic ratio calculation device according to claim 1, wherein

when a larger pixel value indicates a higher degree of X-ray transmittance,

the measurement position estimating unit detects, as the lung right edge candidate, a position at which the pixel value is smallest in a region within a predetermined range from a right edge of the transverse region, and detects, as the lung left edge candidate, a position at which the pixel value in smallest in a region within a predetermined range from a left edge of the transverse region.

3. The cardiothoracic ratio calculation device according to claim 1 or 2, wherein

the measurement position estimating unit detects, as the heart right edge candidate, a position at which the derivative is largest in a negative direction between the lung right edge candidate and the lung left edge candidate in the transverse region, and detects, as the heart left edge candidate, a position at which the derivative is largest in a positive direction between the lung right edge candidate and the lung left edge candidate in the transverse region.

問２.

A technology called “blockchain” is conventionally known. This technology provides a way of synchronizing identical records between a plurality of nodes on a network. When a new record is added to existing records, a block being one record unit is added to the other blocks like a chain while inheriting the content (hash) of the previous block, hence the name “blockchain”. While the term “blockchain” is used to refer to the structure of a database in which blocks are linked in the form of a chain, it can also have a broader meaning to include a system that operates as a P2P network and a system for approving transactions. At present, the term “blockchain” generally does not have a clear definition. Herein, in order to avoid confusion, “blockchain” is used when intending the narrow meaning above, while “blockchain technology” represents the wider meaning encompassing other systems.

Blockchain technology affords many benefits such as zero downtime, difficulty of forging data, and low costs. Therefore, blockchain technology has started to gain attention as a method of managing transactions for not only virtual currency including Bitcoin and other cryptocurrencies based on Bitcoin but also various asset-related information. For example, Non-Patent Document 1 describes that blockchain plays an important role in ensuring reliability and is used to prove the existence and identity of various documents.

Blockchain technology mainly employs two methods being a public node method and a private node method. The public node method is a method that allows anyone to participate as a node on the network, while the private node method is a method where only permitted persons can participate as a node on the network.

問３.

When Backfire Occurs

In the burner 100, when the backfire R enters from the burner element 15, heat of the backfire R causes the thermal expansion members 22 to thermally expand inward

as illustrated in FIG. 3(B), thereby forming the thermal expansion member 222 that closes the opening 22H.

As a result, heat of the backfire R and the ultraviolet light L emitted by the flame F generated by the burner element 15 are suppressed from reaching the flame detection sensor 23 because the opening 22H is closed by the thermal expansion member 222 (22).

In this embodiment, a control unit (not shown) is configured to determine that the burner 100 is burning normally when, for example, the flame detection sensor 23 detects the ultraviolet light L, and determine that backfire or loss of flame has occurred when the quantity of the ultraviolet light L detected by the flame detection sensor 23 is less than or equal to a set threshold value (including zero).

Thus, if the quantity of the detected ultraviolet light L is less than or equal to the threshold value, such as when the burner 100 loses its flame and no longer emits the ultraviolet light L or when the thermal expansion member 22 thermally expands and the flame detection sensor 23 no longer detects the ultraviolet light L as illustrated in FIG. 3(B), the control unit determines that loss of flame or backfire has occurred in the burner 100.