

## Claims

1. A method of generating augmented reality at an electronic device with a camera and a display, comprising:

5        detecting an image capture of a two-dimensional code through a camera video frame,  
wherein detecting image capture of a two-dimensional code through a camera imaging frame  
includes converting the image capture to grayscale and converting the grayscale image  
capture to a binary image capture, and wherein the two-dimensional code is a quick-response  
(QR) code;

10        identifying the contour of the two-dimensional code captured in the camera video  
frame, wherein identifying the contour of the two-dimensional code further includes:

executing the horizontal anchor point characteristic scanning and vertical  
anchor point characteristic scanning against this binary image;

15        obtaining a horizontal anchor point characteristic line and a vertical anchor  
point characteristic line;

calculating the intersection point between the horizontal anchor point  
characteristic line and vertical anchor point characteristic line;

obtaining the position of an anchor point of the QR two-dimensional code,  
corresponding to the calculated intersection point;

20        obtaining the contour of QR two-dimensional code in accordance with the  
calculated position of the anchor point;

         decoding the information embedded in the detected two-dimensional code;

         obtaining content information corresponding to the decoded two-dimensional code;

25        tracking the identified contour of the two-dimensional code within the camera video  
frame to obtain the position information of the two-dimensional code in the camera video  
frame;

         performing augmented reality processing on the two-dimensional code based on the  
content information and the position information; and

30        generating the augmented reality on the device while simultaneously displaying real-  
world imagery on the display of the device, wherein any visual augmented reality is displayed  
in accordance with the location of the two-dimensional code in the video frame.

2. ~~The method of claim 1, wherein the two-dimensional code is a quick-response (QR) code.~~

3. ~~The method of claim 2, wherein detecting image capture of a two-dimensional code through a camera imaging frame includes converting the image capture to grayscale and~~  
5 ~~converting the grayscale image capture to a binary image capture; and~~

~~identifying the contour of the two-dimensional code further includes:~~

~~—— executing the horizontal anchor point characteristic scanning and vertical anchor point characteristic scanning against this binary image;~~

10 ~~—— obtaining a horizontal anchor point characteristic line and a vertical anchor point characteristic line;~~

~~—— calculating the intersection point between the horizontal anchor point characteristic line and vertical anchor point characteristic line;~~

~~—— obtaining the position of an anchor point of the QR two-dimensional code, corresponding to the calculated intersection point;~~

15 ~~—— obtaining the contour of QR two-dimensional code in accordance with the calculated position of the anchor point.~~

4.2. ~~The method of claim 31, wherein tracking the identified contour of the two-dimensional code within the imaging frame to obtain the position information of the two-dimensional code in the imaging frame further includes:~~

20 ~~obtaining an initial camera video grayscale frame and calculating an initial tracking point aggregation within the contour of the two-dimensional code;~~

~~obtaining a current camera video grayscale frame, a previous tracking point aggregation and previous camera video grayscale frame, in accordance with a determination that the initial tracking point aggregation number is greater than a predetermined threshold~~  
25 ~~value;~~

~~calculating a current tracking point aggregation, tracked by the current camera video frame image, by applying the current camera video grayscale frame, previous tracking point aggregation and previous camera video grayscale frame in optic flow tracking modes;~~

30 ~~calculating a homography matrix in accordance with corresponding dotted pairs of the initial tracking point aggregation and current tracking point aggregation.~~

5.3. ~~The method of claim 42, wherein calculating a homography matrix further includes:~~

determining that the current tracking point aggregation does not exceed the predetermined threshold value of the initial tracking point aggregation; and  
calculating the homography matrix in accordance with a determination that the current tracked number of camera video frame images is less than the preset threshold value.

5 | ~~6.4.~~ The method of any of claims 1-53, further comprising:

performing down sampling processing against the camera video frame image and reattempting to detect the two-dimensional code in the camera video frame image, in accordance with a determination that no two-dimensional code is detected in a camera video frame image of the camera video frame.

10 | ~~7.5.~~ The method of any of claims 1-64, further comprising:

terminating the presentation of the augmented reality on the device, in accordance with a determination that no two-dimensional code is detected in a camera video frame image of the camera video frame.

15 | ~~8. The method of claim 1-7, wherein the generating the augmented reality on the device further comprises:~~

~~displaying the augmented reality on the display of the device and in the area occupied by the two-dimensional code in the camera video frame.~~

~~9.6. The method of claim 8 any of claims 1-5, wherein the generating the augmented reality on the device further comprises:~~

20 | displaying the augmented reality on the display of the device and in the area occupied by the two-dimensional code in the camera video frame, and

wherein the displaying the augmented reality on the display of the device and only in the area occupied by the two-dimensional code in the camera video frame further comprises:

25 | converting the size of the augmented reality into the size of the captured two-dimensional code image in the camera video frame.

~~10. The method of claim 8, wherein the displayed augmented reality is a three-dimensional representation, based on the content and position information of the two-dimensional code.~~

11.7. The method of claim 106, wherein the displayed augmented reality is a three-dimensional representation, based on the content and position information of the two-dimensional code, and wherein the displaying the augmented reality on the display of the device and only in the area occupied by the two-dimensional code in the camera video frame  
5 further comprises:

calculating a transformation matrix of polar coordinates of a three-dimensional model to the two-dimensional coordinates of the display screen; and

using the transformation matrix to overlay the three-dimensional model in the camera video frame image according to the position information of the two-dimensional code in  
10 camera video frame image.

12.8. An electronic device, comprising:

a display;

a camera;

one or more processors;

15 memory; and

one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the one or more processors, the one or more programs including instructions for:

detecting an image capture of a two-dimensional code through a camera video  
20 frame, wherein detecting image capture of a two-dimensional code through a camera imaging frame includes converting the image capture to grayscale and converting the grayscale image capture to a binary image capture, and wherein the two-dimensional code is a quick-response (QR) code;

identifying the contour of the two-dimensional code captured in the camera  
25 video frame, wherein identifying the contour of the two-dimensional code further includes:

executing the horizontal anchor point characteristic scanning and vertical anchor point characteristic scanning against this binary image;

obtaining a horizontal anchor point characteristic line and a vertical anchor point characteristic line;

30 calculating the intersection point between the horizontal anchor point characteristic line and vertical anchor point characteristic line;

obtaining the position of an anchor point of the QR two-dimensional code,  
corresponding to the calculated intersection point;

obtaining the contour of QR two-dimensional code in accordance with the  
calculated position of the anchor point;

5            decoding the information embedded in the detected two-dimensional code;  
             obtaining content information corresponding to the decoded two-dimensional  
code;

             tracking the identified contour of the two-dimensional code within the camera  
video frame to obtain the position information of the two-dimensional code in the camera  
10    video frame;

             performing augmented reality processing on the two-dimensional code based  
on the content information and the position information; and

             generating the augmented reality on the device while simultaneously  
displaying real-world imagery on the display of the device, wherein any visual augmented  
15    reality is displayed in accordance with the location of the two-dimensional code in the video  
frame.

~~13. — The device of claim 12, wherein the two-dimensional code is a quick response (QR)  
code.~~

~~14.    The device of claim 13, wherein detecting image capture of a two-dimensional code  
20    through a camera imaging frame includes converting the image capture to grayscale and  
converting the grayscale image capture to a binary image capture; and~~

~~identifying the contour of the two-dimensional code further includes:~~

~~— executing the horizontal anchor point characteristic scanning and vertical  
anchor point characteristic scanning against this binary image;~~

25            ~~— obtaining a horizontal anchor point characteristic line and a vertical anchor  
point characteristic line;~~

~~— calculating the intersection point between the horizontal anchor point  
characteristic line and vertical anchor point characteristic line;~~

~~— obtaining the position of an anchor point of the QR two-dimensional code,  
30    corresponding to the calculated intersection point;~~

~~— obtaining the contour of QR two-dimensional code in accordance with the  
calculated position of the anchor point.~~

~~15, 9.~~ The device of claim ~~14~~8, wherein tracking the identified contour of the two-dimensional code within the imaging frame to obtain the position information of the two-dimensional code in the imaging frame further includes instructions for:

obtaining an initial camera video grayscale frame and calculating an initial tracking point aggregation within the contour of the two-dimensional code;

obtaining a current camera video grayscale frame, a previous tracking point aggregation and previous camera video grayscale frame, in accordance with a determination that the initial tracking point aggregation number is greater than a predetermined threshold value;

calculating a current tracking point aggregation, tracked by the current camera video frame image, by applying the current camera video grayscale frame, previous tracking point aggregation and previous camera video grayscale frame in optic flow tracking modes;

calculating a homography matrix in accordance with corresponding dotted pairs of the initial tracking point aggregation and current tracking point aggregation.

~~16, 10.~~ The device of claim ~~15~~9, wherein calculating a homography matrix further includes instructions for:

determining that the current tracking point aggregation does not exceed the predetermined threshold value of the initial tracking point aggregation; and

calculating the homography matrix in accordance with a determination that the current tracked number of camera video frame images is less than the preset threshold value.

~~17, 11.~~ The device of any of claims ~~12-16~~8-10, further including instructions for:

performing down sampling processing against the camera video frame image and attempting to detect the two-dimensional code in the camera video frame image, in accordance with a determination that no two-dimensional code is detected in a camera video frame image of the camera video frame.

~~18, 12.~~ The device of any of claims ~~12-17~~8-11, further including instructions for:

terminating the presentation of the augmented reality on the device, in accordance with a determination that no two-dimensional code is detected in a camera video frame image of the camera video frame.

~~19.~~ The device of any of claims ~~12-18~~, wherein the generating the augmented reality on the device further comprises instructions for:

~~displaying the augmented reality on the display of the device and in the area occupied by the two-dimensional code in the camera video frame.~~

~~20.13.~~ The device of ~~claim 19~~any of claims 8-12, wherein the generating the augmented reality on the device further comprises instructions for:

displaying the augmented reality on the display of the device and in the area occupied by the two-dimensional code in the camera video frame, and

wherein the displaying the augmented reality on the display of the device and only in the area occupied by the two-dimensional code in the camera video frame further comprises instructions for:

converting the size of the augmented reality into the size of the captured two-dimensional code image in the camera video frame.

~~21.— The device of claim 19, wherein the displayed augmented reality is a three-dimensional representation, based on the content and position information of the two-dimensional code.~~

~~22.14.~~ The device of any of claims 8-12-21, wherein the generating the augmented reality on the device further comprises instructions for:

displaying the augmented reality on the display of the device and in the area occupied by the two-dimensional code in the camera video frame,

wherein the displayed augmented reality is a three-dimensional representation, based on the content and position information of the two-dimensional code , and

wherein the displaying the augmented reality on the display of the device and only in the area occupied by the two-dimensional code in the camera video frame further comprises instructions for:

calculating a transformation matrix of polar coordinates of a three-dimensional model to the two-dimensional coordinates of the display screen; and

using the transformation matrix to overlay the three-dimensional model in the camera video frame image according to the position information of the two-dimensional code in camera video frame image.

23-15. A non-transitory computer readable storage medium storing one or more programs, the one or more programs comprising instructions, which when executed by an electronic device with a display and a camera, cause the device to:

5 detect an image capture of a two-dimensional code through a camera video frame, wherein detecting image capture of a two-dimensional code through a camera imaging frame includes converting the image capture to grayscale and converting the grayscale image capture to a binary image capture, and wherein the two-dimensional code is a quick-response (QR) code;

10 identify the contour of the two-dimensional code captured in the camera video frame, wherein identifying the contour of the two-dimensional code further includes instructions that cause the device to:

execute the horizontal anchor point characteristic scanning and vertical anchor point characteristic scanning against this binary image;

15 obtain a horizontal anchor point characteristic line and a vertical anchor point characteristic line;

calculate the intersection point between the horizontal anchor point characteristic line and vertical anchor point characteristic line;

20 obtain the position of an anchor point of the QR two-dimensional code, corresponding to the calculated intersection point;

25 obtain the contour of QR two-dimensional code in accordance with the calculated position of the anchor point;

decode the information embedded in the detected two-dimensional code;

obtain content information corresponding to the decoded two-dimensional code;

25 track the identified contour of the two-dimensional code within the camera video frame to obtain the position information of the two-dimensional code in the camera video frame;

perform augmented reality processing on the two-dimensional code based on the content information and the position information; and

30 generate the augmented reality on the device while simultaneously displaying real-world imagery on the display of the device, wherein any visual augmented reality is displayed in accordance with the location of the two-dimensional code in the video frame.

24.—The non-transitory computer readable storage medium of claim 23, wherein the two-dimensional code is a quick response (QR) code.

25.—The non-transitory computer readable storage medium of claim 24, wherein detecting image capture of a two-dimensional code through a camera imaging frame includes  
5 converting the image capture to grayscale and converting the grayscale image capture to a binary image capture; and

identifying the contour of the two-dimensional code further includes instructions that cause the device to:

———execute the horizontal anchor point characteristic scanning and vertical anchor  
10 point characteristic scanning against this binary image;

———obtain a horizontal anchor point characteristic line and a vertical anchor point characteristic line;

———calculate the intersection point between the horizontal anchor point characteristic line and vertical anchor point characteristic line;

15 ———obtain the position of an anchor point of the QR two-dimensional code, corresponding to the calculated intersection point;

———obtain the contour of QR two-dimensional code in accordance with the calculated position of the anchor point.

26.16. The non-transitory computer readable storage medium of claim 2515, wherein  
20 tracking the identified contour of the two-dimensional code within the imaging frame to obtain the position information of the two-dimensional code in the imaging frame further includes instructions that cause the device to:

obtain an initial camera video grayscale frame and calculating an initial tracking point aggregation within the contour of the two-dimensional code;

25 obtain a current camera video grayscale frame, a previous tracking point aggregation and previous camera video grayscale frame, in accordance with a determination that the initial tracking point aggregation number is greater than a predetermined threshold value;

calculate a current tracking point aggregation, tracked by the current camera video frame image, by applying the current camera video grayscale frame, previous tracking point  
30 aggregation and previous camera video grayscale frame in optic flow tracking modes;

calculate a homography matrix in accordance with corresponding dotted pairs of the initial tracking point aggregation and current tracking point aggregation.

~~27.17~~ The non-transitory computer readable storage medium of claim ~~26~~16, wherein calculating a homography matrix further includes instructions that cause the device to:

determine that the current tracking point aggregation does not exceed the predetermined threshold value of the initial tracking point aggregation; and

calculate the homography matrix in accordance with a determination that the current tracked number of camera video frame images is less than the preset threshold value.

~~28.18.~~ The non-transitory computer readable storage medium of any of claims ~~23-27~~15-17, further comprising instructions that cause the device to:

perform down sampling processing against the camera video frame image and attempting to detect the two-dimensional code in the camera video frame image, in accordance with a determination that no two-dimensional code is detected in a camera video frame image of the camera video frame.

~~29.19.~~ The non-transitory computer readable storage medium of any of claims ~~23-28~~15-17, further comprising instructions that cause the device to:

terminate the presentation of the augmented reality on the device, in accordance with a determination that no two-dimensional code is detected in a camera video frame image of the camera video frame.

~~30.—The non-transitory computer readable storage medium of any of claims 23-29, wherein the generating the augmented reality on the device further comprises instructions that cause the device to:~~

~~display the augmented reality on the display of the device and in the area occupied by the two-dimensional code in the camera video frame.~~

~~31.20.~~ The non-transitory computer readable storage medium of ~~claim 30~~any of claims 15-19, wherein the generating the augmented reality on the device further comprises instructions that cause the device to:

display the augmented reality on the display of the device and in the area occupied by the two-dimensional code in the camera video frame, and

wherein the displaying the augmented reality on the display of the device and only in the area occupied by the two-dimensional code in the camera video frame further comprises instructions that cause the device to:

convert the size of the augmented reality into the size of the captured two-dimensional code image in the camera video frame.

~~32. The non-transitory computer readable storage medium of claim 30, wherein the displayed augmented reality is a three-dimensional representation, based on the content and position information of the two-dimensional code.~~

~~33~~21. The non-transitory computer readable storage medium of any of claims 32~~15-19~~, wherein the generating the augmented reality on the device further comprises instructions that cause the device to:

display the augmented reality on the display of the device and in the area occupied by the two-dimensional code in the camera video frame

wherein the displayed augmented reality is a three-dimensional representation, based on the content and position information of the two-dimensional code, and

wherein the displaying the augmented reality on the display of the device and only in the area occupied by the two-dimensional code in the camera video frame further comprises instructions that cause the device to:

calculate a transformation matrix of polar coordinates of a three-dimensional model to the two-dimensional coordinates of the display screen; and

use the transformation matrix to overlay the three-dimensional model in the camera video frame image according to the position information of the two-dimensional code in camera video frame image.

~~34~~22. An electronic device, comprising:

a display unit configured to display real-world imagery and visual augmented reality;

a camera unit configured to capture images and video through a camera video frame;

and

a processing unit coupled to the display unit and the camera unit, the processing unit comprising:

a two-dimensional code detection unit configured to detect an image capture of a two-dimensional code in the camera video frame image so as to obtain the contour of the two-dimensional code, wherein the two-dimensional code is a quick-response (QR) code, and wherein the two-dimensional code detection unit is further configured to:

transform the camera video frame image to grayscale image, and transform the mentioned grayscale image into binary image;

execute the horizontal anchor point characteristic scanning and vertical anchor point characteristic scanning against this binary image so as to obtain the horizontal anchor point characteristic line and vertical anchor point characteristic line;

calculate the intersection point between the horizontal anchor point characteristic line and vertical anchor point characteristic line so as to obtain the position of anchor point of QR two-dimensional code; and

obtain the contour of this QR two-dimensional code according to the calculated position of anchor point of QR two-dimensional code;

a recognition tracking unit configured to obtain the content information of the two-dimensional code, and to track this two-dimensional code so as to obtain the position information of the two-dimensional code in the camera video frame image; and

an augmented reality unit configured to perform augmented reality processing on the two-dimensional code based on the content information and position information of the two-dimensional code in the camera video frame image, and generate the augmented reality on the device while simultaneously displaying real-world imagery on the display of the device, wherein any visual augmented reality is displayed in accordance with the location of the two-dimensional code in the video frame.

~~35.—The electronic device of claim 34, wherein the two-dimensional code is a quick-response (QR) code.~~

~~36.—The electronic device of claim 35, wherein the two-dimensional code detection unit is further configured to:~~

~~transform the camera video frame image to grayscale image, and transform the mentioned grayscale image into binary image;~~

~~execute the horizontal anchor point characteristic scanning and vertical anchor point characteristic scanning against this binary image so as to obtain the horizontal anchor point characteristic line and vertical anchor point characteristic line;~~

~~calculate the intersection point between the horizontal anchor point characteristic line and vertical anchor point characteristic line so as to obtain the position of anchor point of QR two-dimensional code; and~~

~~obtain the contour of this QR two-dimensional code according to the calculated position of anchor point of QR two-dimensional code.~~

37:23. The electronic device of claim 35:22, wherein the recognition tracking unit is further configured to:

obtain the corresponding initial camera video grayscale frame according to the contour of two-dimensional code and calculate the initial tracking point aggregation within the contour of this two-dimensional code;

obtain the current camera video grayscale frame, previous tracking point aggregation and previous camera video grayscale frame, in accordance with a determination that the initial tracking point aggregation number is greater than a preset threshold value;

calculate a current tracking point aggregation, tracked by the current camera video frame image, by applying the current camera video grayscale frame, previous tracking point aggregation and previous camera video grayscale frame in optic flow tracking modes; and

calculate the homography matrix in accordance with corresponding dotted pairs of the initial tracking point aggregation and current tracking point aggregation.

38:24. The electronic device of claim 37:23, wherein the recognition tracking unit is further configured to:

determine that the current tracking point aggregation does not exceed the predetermined threshold value of the initial tracking point aggregation; and

calculate the homography matrix in accordance with a determination that the current tracked number of camera video frame images is less than the preset threshold value.

39:25. The electronic device of any of claims 34-38:22-24, wherein the two-dimensional code detection unit is further configured to, when no two-dimensional code is detected in the camera video frame image, perform downsampling treatment against the camera video frame image, and detect the two-dimensional code in the camera video frame image after performing the downsampling treatment.

4026. The electronic device of any of claims 34-39~~22-25~~, wherein the two-dimensional code detection unit is further configured to terminate the presentation of the augmented reality on the device, when no two-dimensional code is detected in the camera video frame image.

~~41. The electronic device of claim 34-40, wherein the augmented reality unit is further configured to display the augmented reality on the display of the device and in the area occupied by the two-dimensional code in the camera video frame.~~

~~42.~~27. The electronic device of ~~claim 41~~ any of claims 22-26, wherein the augmented reality unit is further configured to display the augmented reality on the display of the device and in the area occupied by the two-dimensional code in the camera video frame, and

wherein the augmented reality unit is further configured to convert the size of the augmented reality into the size of the captured two-dimensional code image in the camera video frame.

~~43. The electronic device of claim 41, wherein the augmented reality unit is further configured to display the augmented reality as a three-dimensional representation, based on the content and position information of the two-dimensional code.~~

~~44.~~28. The electronic device of any of claims 43~~22-26~~, wherein the augmented reality unit is further configured to display the augmented reality on the display of the device and in the area occupied by the two-dimensional code in the camera video frame,

wherein the augmented reality unit is further configured to display the augmented reality as a three-dimensional representation, based on the content and position information of the two-dimensional code, and

wherein the augmented reality unit is further configured to:

calculate a transformation matrix of polar coordinates of a three-dimensional model to the two-dimensional coordinates of the display screen; and

use the transformation matrix to overlay the three-dimensional model in the camera video frame image according to the position information of the two-dimensional code in camera video frame image.