

FORM 5
THE PATENTS ACT, 1970
(39 of 1970)
&
THE PATENTS RULES, 2003
DECLARATION AS TO INVENTORSHIP
(See section 10(6) and rule 13(6))

1. APPLICANT(S)

NAME	NATIONALITY	ADDRESS
CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING	INDIAN	PLOT - E-2/1, BLOCK-GP, SECTOR-V SALT LAKE ELECTRONICS COMPLEX BIDHAN NAGAR, Kolkata, West Bengal, 700091, India

hereby declare that the true and first inventor(s) of the invention disclosed in the complete specification filed in pursuance of our Application No.: _____ dated **24/08/2020** titled "**A ROTATIONAL THERMO-GRAPHIC IMAGING BASED BREAST CANCER SCREENING SYSTEM**" is/are

2. INVENTOR(S)

NAME	NATIONALITY	ADDRESS
ASOK BANDYOPADHYAY	INDIAN	ASSOCIATE DIRECTOR, CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING,KOLKATA West Bengal, 700091, India
HIMANKA SEKHAR MONDAL	INDIAN	PROJECT ENGINEER, CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING,KOLKATA, West Bengal, 700091, India
DEBABRATA PAL	INDIAN	PRINCIPAL ENGINEER, CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING,KOLKATA, West Bengal, 700091, India
SAYANTANI BANERJEE	INDIAN	T&M SERVICES CONSULTING PVT LTD.(WORKING FOR CDAC,KOLKATA), West Bengal, 700091, India
MAMATA CHAKRABORTY	INDIAN	T&M SERVICES CONSULTING PVT LTD.(WORKING FOR CDAC,KOLKATA), West Bengal, 700091, India
BARNALI PAL	INDIAN	JOINT DIRECTOR, CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING,KOLKATA, West Bengal, 700091, India
AMIT CHAUDHURI	INDIAN	ASSOCIATE DIRECTOR (Retd.), CENTRE FOR DEVELOPMENT OF ADVANCED

		COMPUTING,KOLKATA,West Bengal, 700091, India
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3. DECLARATION TO BE GIVEN WHEN THE APPLICATION IN INDIA IS FILED BY THE APPLICANT(S) IN THE CONVENTION COUNTRY: -

I/We the applicant(s) in the convention country hereby declare that our right to apply for a patent in India is by way of assignment from the true and first inventor(s).

4. STATEMENT (to be signed by the additional inventor(s) not mentioned in the application form) NIL

Dated this 24th day of August, 2015



SAURBH VAID
IN/PA-1814
L.S. DAVAR & CO.,
APPLICANT'S AGENT
To,
The Controller of Patents
The Patent Office at Kolkata

202031036632

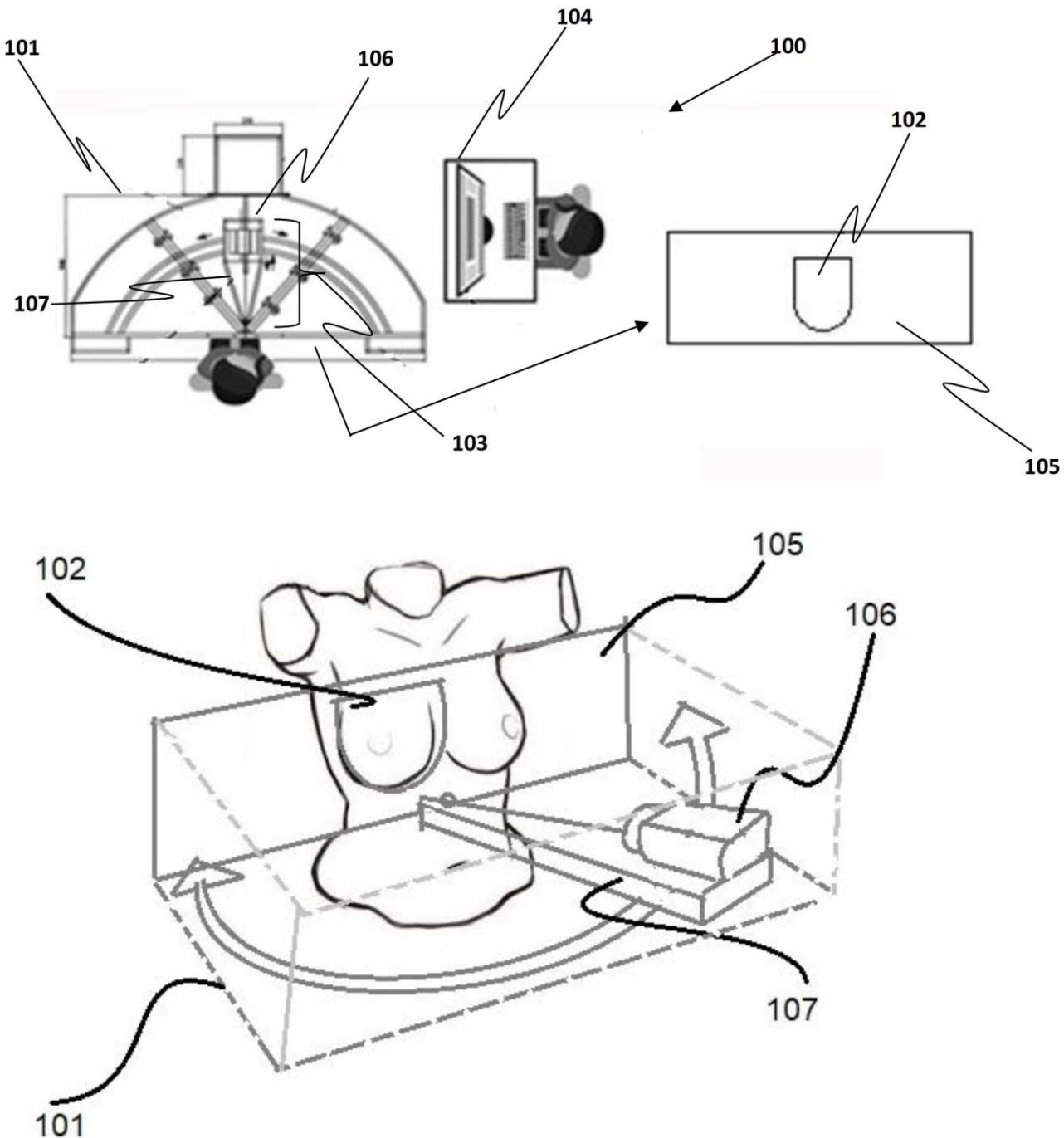


Figure 1

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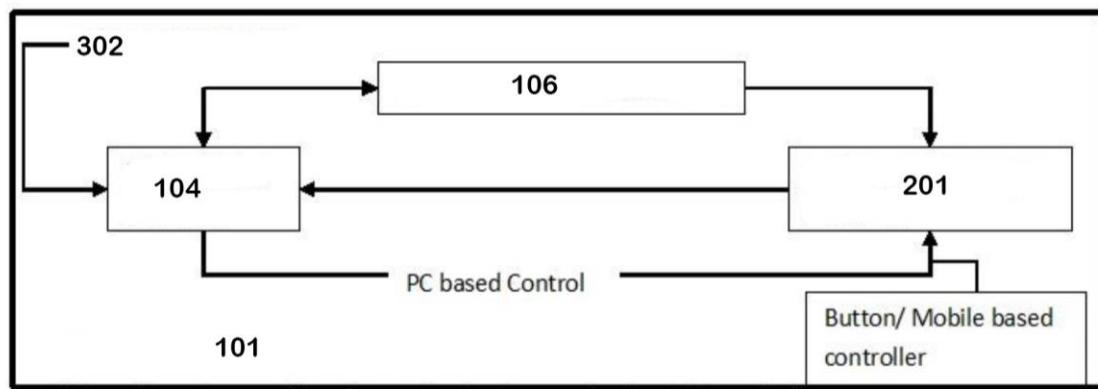


Figure 2

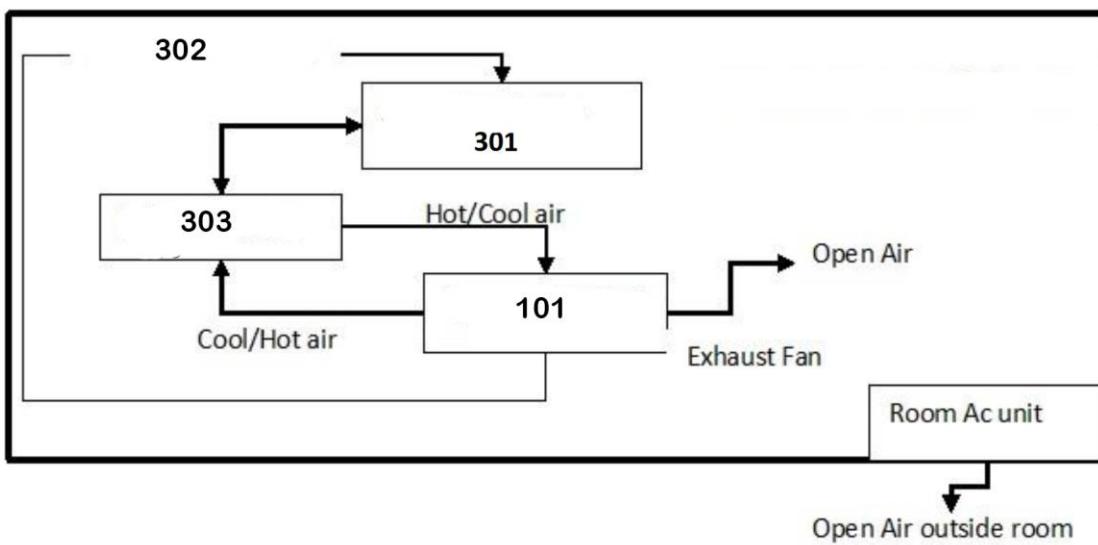
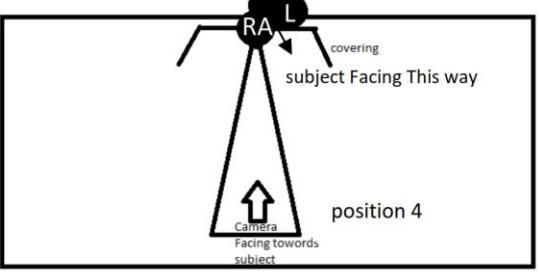
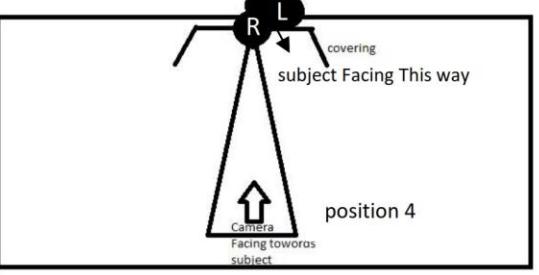
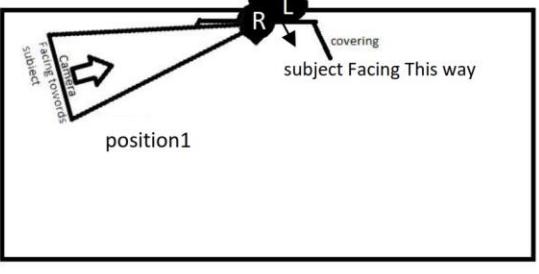
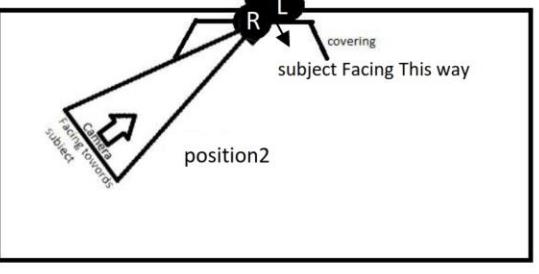
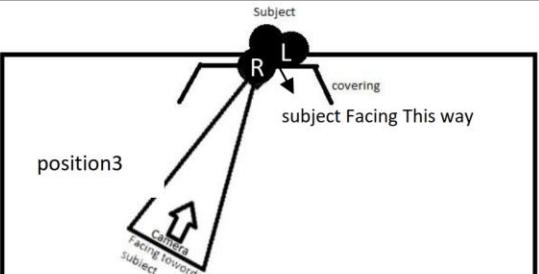
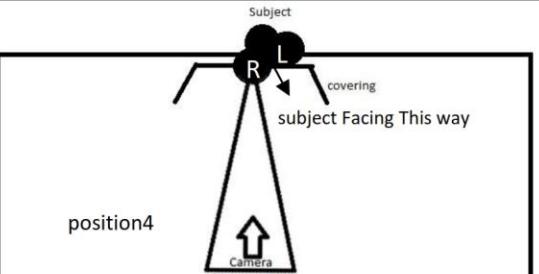


Figure 3

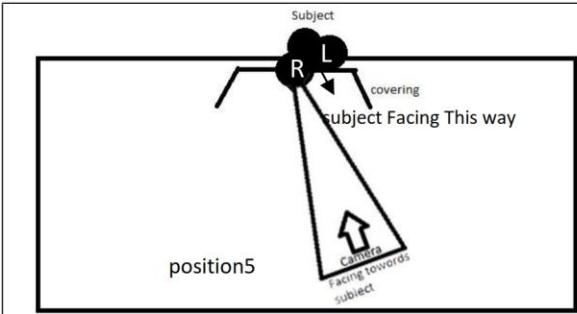
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 <p>Subject RA L covering subject Facing This way position 4</p>	 <p>Subject R L covering subject Facing This way position 4</p>
 <p>Subject R L covering subject Facing This way position1</p>	 <p>Subject R L covering subject Facing This way position2</p>
 <p>Subject R L covering subject Facing This way position3</p>	 <p>Subject R L covering subject Facing This way position4</p>

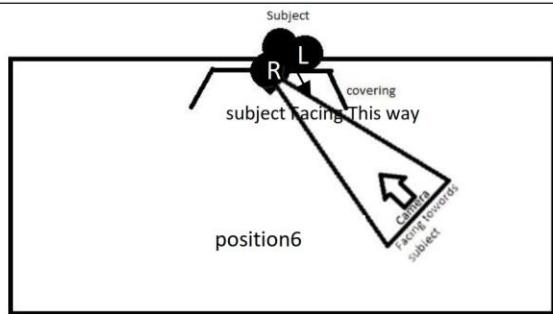

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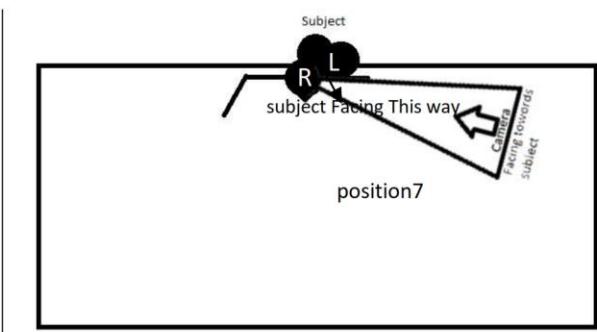


Action 7: Move the attachment 120° and Capture

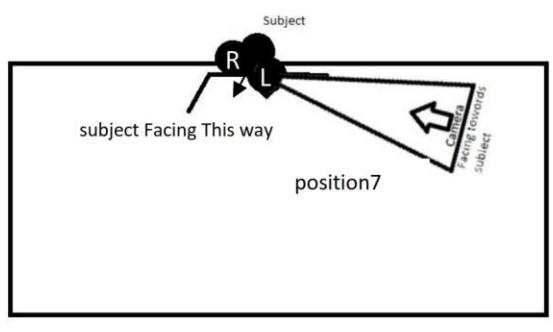


Action 8: Move the attachment 150° and Capture

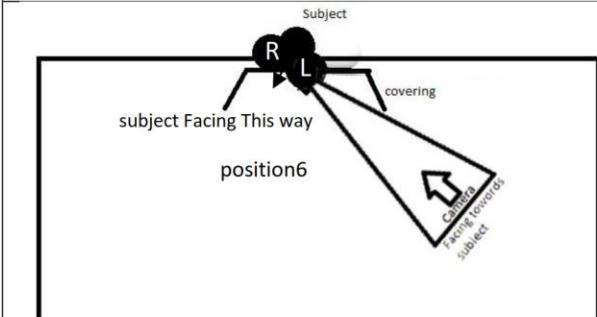
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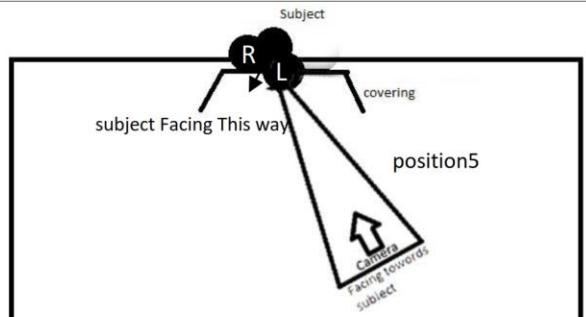
Action 9: Move the attachment 180° and Capture



Action 10: Keep the attachment 180° , Move the body to Left (L) position and Capture



Action 11: Move the attachment 150° and Capture

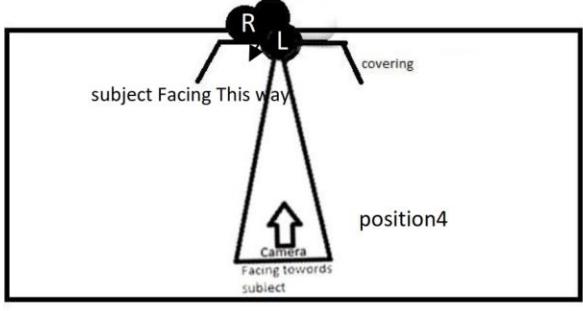
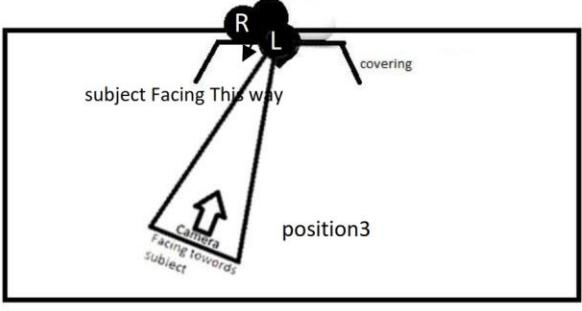
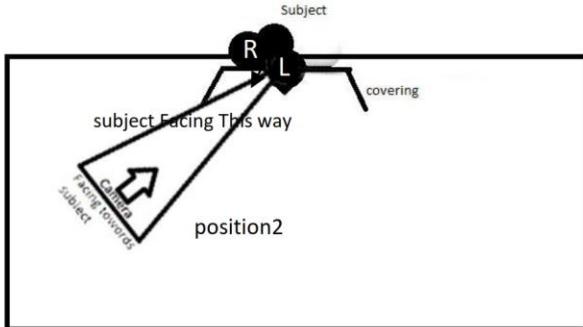
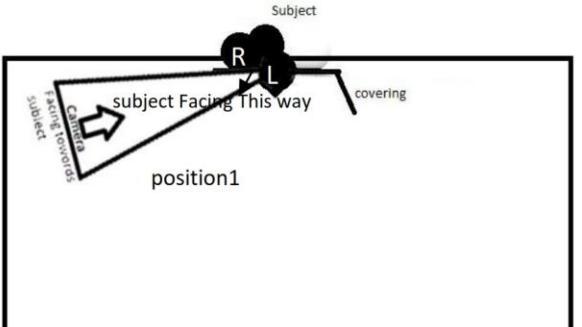


Action 12: Move the attachment 120° and Capture

(VAID SAURABH)

Reg. No. IN/PA - 1814
L. S. DAVAR & CO.
APPLICANTS' AGENT

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 <p>subject Facing This way</p> <p>position4</p>	 <p>subject Facing This way</p> <p>position3</p>
<p>Action 13: Move the attachment 90° and Capture</p>  <p>subject Facing This way</p> <p>position2</p>	<p>Action 14: Move the attachment 60° and Capture</p>  <p>subject Facing This way</p> <p>position1</p>
<p>Action 15: Move the attachment 30° and Capture</p>	<p>Action 16: Move the attachment 0° and Capture</p>

Cont....

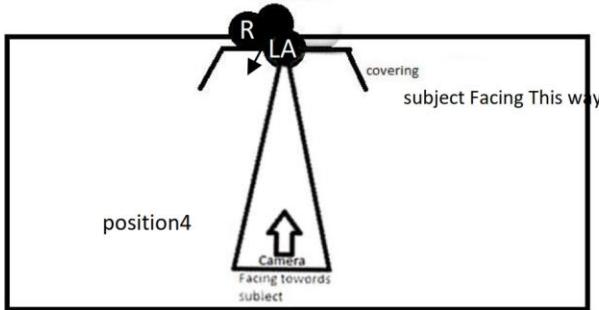
 <p>position4</p> <p>subject Facing This way</p>
<p>Action 17: Move the attachment 90° , Move the body to Left Axila b(LA) position, Focus at Left axila and Capture</p>

Figure 4

FORM 2

THE PATENTS ACT 1970

39 OF 1970

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THE PATENT RULES 2003

COMPLETE SPECIFICATION

(SEE SECTIONS 10 & RULE 13)

1. TITLE OF THE INVENTION

**"A ROTATIONAL THERMO-GRAPHIC IMAGING BASED BREAST
CANCER SCREENING SYSTEM"**

2. APPLICANTS (S)

NAME	NATIONALITY	ADDRESS
CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING	Indian	Plot - E-2/1, Block-GP, Sector-V Salt Lake Electronics Complex Bidhannagar, Kolkata – 700091 West Bengal (India)

3. PREAMBLE TO THE DESCRIPTION

COMPLETE SPECIFICATION

The following specification particularly describes the invention and the manner
in which it is to be performed

A ROTATIONAL THERMO-GRAPHIC IMAGING BASED BREAST CANCER SCREENING SYSTEM

FIELD OF THE INVENTION

[001] The present disclosure, in general, relates to a breast cancer screening system and more particularly, to a rotational thermo-graphic imaging based breast cancer screening system.

BACKGROUND OF THE INVENTION

[002] Breast cancer is a major cause of mortality in women. One of the factors that influence the chances of curing a patient having breast cancer is early detection of the disease.

[003] Several breast cancer imaging techniques are used in worldwide in different studies. In most of the previous works, common technique for breast cancer screening using Infrared imaging and the images are collected in sitting position with subjects having two arms up. The Infrared camera is placed at a distance so that front view of both breasts is visible in the camera field of view (FOV). It is not possible to get complete imaging of each breast by this imaging technique as it is not able to capture breast image from all the viewing angles.

[004] Another technique for the same imaging is to use multiple camera attachments to get both the breast images individually. These techniques have some disadvantages in distinguishing between foreground and background where one breast acts as foreground and other breast acts as background.

[005] Another technique is used to collect the infrared images by rotating the subject on a rotational chair or stool keeping the IR Camera fixed, which has also same disadvantage in focusing. In that case focusing the breast in FOV of camera has to be done each time as the distances from camera to focus point varies from one angle to another angle with different rotational positions of the body which is a cumbersome process. The same problem remains if the camera is rotated and

subject is fixed while camera is focused with respect to the body instead of the breast.

[006] Another study shows some different body positioning like prone position where camera is placed underneath a table where breast hangs through a hole in the table but this position is uncomfortable by the patients. Further, it is also observed that most of the studies do not reflect integrated software for IR image analysis and reporting. Above constraints have been removed in our system.

[007] Therefore, there is a need to develop a rotational thermo-graphic imaging based breast cancer screening system which can obviate the drawbacks mentioned above.

OBJECT OF THE INVENTION

[008] It is therefore an object of the present invention, to solve the aforementioned and other drawbacks existing in the existingbreast cancer screening system.

[009] Another primary object of the present invention is to provide a rotational thermo-graphic imaging based breast cancer screening system for complete imaging of breast.

[0010] Yet another objective of the present invention is to provide a rotational thermo-graphic imaging based breast cancer screening system having a rotating camera arm.

[0011] Yet another object of the present invention is to provide a rotational thermo-graphic imaging based breast cancer screening system which provides best comfort to the subject in sitting position.

[0012] Yet another object of the present invention is to provide a rotational thermo-graphic imaging based breast cancer screening system which can operate in non-contact way.

[0013] Yet another object of the present invention is to provide a rotational thermo-graphic imaging based breast cancer screening system to take images at different temperatures.

[0014] Still yet another object of the present invention is to provide a rotational thermo-graphic imaging based breast cancer screening system to take images in thermally controlled environment.

SUMMARY OF THE INVENTION

[0015] One or more drawbacks of breast cancer screening system and additional advantages are provided through the rotational thermo-graphic imaging based breast cancer screening system as claimed in the present disclosure. Additional features and advantages are realized through the technicalities of the present disclosure. Other embodiments and aspects of the disclosure are described in detail herein and are considered to be a part of the claimed disclosure.

[0016] The present subject matter relates to a rotational thermo-graphic imaging based breast cancer screening system. The breast cancer screening system comprises a temperature controlled enclosure with adjustable groove hole, an air conditioning unit controller, an image capturing sub-unit and a computer. The adjustable groove hole is provided in the front wall of the temperature controlled enclosure to accommodate one breast. In the temperature controlled enclosure, a set temperature is maintained by the air conditioning unit controller. The image capturing sub-unit is provided in the temperature controlled enclosure to capture thermo-graphic image of the breast accommodated in the adjustable grooved hole of the temperature controlled enclosure. The image capturing sub-unit comprises an infra-red camera provided at an end of a rotating arm to facilitate capturing of the thermo-graphic image of breast from different angles and from both axilla. The computer is electronically connected to the image capturing sub-unit and air conditioning unit controller to operate the movement of the image capturing sub-unit and capturing the thermo-graphic images from different angles. The thermo-

graphic images are analyzed for detection of abnormality of the breast at each angle.

[0017] In an aspect, movement of the image capturing sub-unit is controlled using a motor controller configured to be operated via the computer.

[0018] In an aspect, the image capturing sub-unit preferably moves in a semi-circular path to capture the thermo-graphic images of the breast from different angles and from both axilla.

[0019] In an aspect, the image capturing sub-unit rotates, such that, the distance between the IR camera and the adjustable grooved hole in the temperature controlled enclosure, where breast is accommodated, remains constant resulting in focusing of the IR camera on the adjustable grooved hole.

[0020] In an aspect, the distance between the IR camera and the adjustable grooved hole in the temperature controlled enclosure, where breast is accommodated, depends on the minimal focus distance of the IR camera.

[0021] In an aspect, at least two set of images from different angles and both axilla are taken, each set being taken at different temperature, to extract the dynamic nature of thermo gram due to angiogenesis in malignant breast.

[0022] In an aspect, the temperature of the room where the system is kept is maintained at a constant temperature via an external air conditioning unit.

[0023] In an aspect, the adjustable grooved hole is preferably semi-circular.

[0024] In an aspect, the adjustable grooved hole is made adjustable to different size of breast by providing different templates.

[0025] In an aspect, a table top mechanical arrangement is provided in the system to facilitate capturing of thermo-graphic image of one breast at a time by covering the other breast behind an infra-red proof wall.

[0026] In an aspect, a temperature sensor is placed inside the temperature controlled enclosure to provide the temperature of the enclosure to the air conditioning unit controller.

[0027] In an aspect, the air conditioning unit controller controls an internal air conditioning unit provided on the temperature controlled enclosure based on the temperature provided by the temperature sensor to maintain constant temperature inside the temperature controlled enclosure.

[0028] In order to further understand the characteristics and technical contents of the present invention, a description relating thereto has been made with reference to the accompanying drawings. However, the drawings are illustrative only but not used to limit scope of the present subject matter.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

[0029] Further objects and advantages of this invention will be more apparent from the description when read in conjunction with accompanying drawings of exemplary embodiments of invention and wherein:

[0030] Figure 1 illustrates top view of present rotational thermo-graphic imaging based cancer screening system, according to one of the embodiment of present subject matter;

[0031] figure 2 illustrates block diagram of connections for rotating arm control and data collection by computer, according to one of the embodiment of present subject matter;

[0032] Figure 3 illustrates block diagram for room and system temperature control according to one of the embodiment of present subject matter;and

[0033] Figure 4 illustrating top view of the image capturing sub-unit at different position for IR imaging capturing according to one of the embodiment of present subject matter.

DETAILED DESCRIPTION OF THE INVENTION

[0034] The present invention discloses a rotational thermo-graphic imaging based breast cancer screening system 100.

[0035] Referring to Figure 1 illustrating top view of present rotational thermo-graphic imaging based cancer screening system 100, according to one of the embodiment of present subject matter. The rotational thermo-graphic imaging based cancer screening system 100 comprises a temperature controlled enclosure 101 having an adjustable grooved hole 102, an air conditioning unit controller, an image capturing sub-unit 103 and a computer 104. The temperature controlled enclosure 101 is set up on a table top to ensure convenience of subject to sit properly. The adjustable grooved hole 102 is provided on the front wall 105 of the temperature controlled enclosure 101 to accommodate one breast of subject. The shape of the adjustable grooved hole 102 is preferably semi-circular and can be adjusted to various sizes according to the requirements by using different templates. The adjusting nature of the adjustable grooved hole 102 facilitate good positioning for IR imaging and provide comfort to the subject during whole process. The front wall 105 of the temperature controlled enclosure 101 is made up of infra-red proof wall, so that, IR imaging of only one breast can be performed at a time.

[0036] The image capturing sub-unit 103 is provided in the temperature controlled enclosure 101 facing the adjustable grooved hole 102 to capture thermo-graphic images of the breast accommodated in the adjustable grooved hole 102. The image capturing sub-unit 103 comprises an infra-red camera 106 provided at end of a rotating arm 107 to facilitate capturing of the thermo-graphic images of the breast from different angles and from both axilla.

[0037] In the preferred embodiment, the rotating arm 107 of the image capturing sub-unit 103 move in a semi-circular path, with the adjustable grooved hole 102 as a center, to facilitate capturing of the thermo-graphic images of the breast from different angles and from both the axilla. This arrangement further maintains same

distance between the IR camera 106 and the adjustable grooved hole 102 in the temperature controlled enclosure 101 which results in focusing of the IR camera 106 on the adjustable grooved hole 102 where the breast of the subject is accommodated.

[0038] The distance between the IR camera 106 and the adjustable grooved hole 102 in the temperature controlled enclosure 101 depends on the minimal focus distance of the IR camera 106. This ensure clear images at each and every position.

[0039] Referring to Figure 2 illustrating block diagram of connections for rotating arm 107 control and data collection by computer 104, according to one of the embodiment of present subject matter. In the preferred embodiment, a motor controller 201 is provided to facilitate movement of the image capturing sub-unit 103. The motor controller 201 is electronically connected to the computer 104 to operate the image capturing sub-unit 103. The computer 104 act as a controller and controls the functioning, such as, movement and capturing of images as predetermined angles of the image capturing sub-unit 103. The captured images are further processed in the computer 104 via a software specially designed for the said purpose. The software is a proprietary copyrighted software of the applicant bearing registration number SW-12853/2019. The software analyze the captured images by executing a novel technique which is implemented in temperature-based area features for explainable AI in machine language techniques, pseudo color and clustering based IR image segmentation, thermal region of interest extraction using masking and color plot based representation for detection of abnormalities in thermo-graphic images of the breast at each angle.

[0040] Referring to figure 3 illustrating block diagram for room and system temperature control according to one of the embodiment of present subject matter. The temperature of the temperature controlled enclosure is controlled by the air conditioning unit controller 301. A temperature sensor 302 is employed inside the temperature controlled enclosure 101 to measure the temperature maintained

inside the enclosure 101. An internal air conditioning unit 303 is provided to raise or lower the temperature of the temperature controlled enclosure 101 based measurement provided by the sensor 302 and as per the requirement. The temperature inside the temperature controlled enclosure 101 is maintained constant while taking each set of thermo-graphic images at different angles. At least two set of images from different angles and both axilla are taken. Each set of the thermo-graphic images is taken at different temperature to extract the dynamic nature of thermo gram due to angiogenesis in malignant breast. Further, the temperature of the room where this system 100 is kept is also maintained at constant temperature via an external air conditioning unit.

WORKING OF THE SYSTEM

[0041] Referring to Figure 4 illustrating top view of the image capturing sub-unit 103 at different position for IR imaging capturing according to one of the embodiment of present subject matter. The temperature of the temperature controlled enclosure 101 is maintained at a specific temperature. The temperature of the room is also maintained at a specific temperature. The subject is to be seated in front of the system 100 and one breast is placed in the adjustable grooved hole 102. The size of the adjustable grooved hole 102 is adjusted using a suitable template for better comfort of the subject. The pivot point of the camera 106 focus is set at the adjustable grooved hole 102, so that the breast which is placed at the camera 106 FOV is always in same focal distance. The position of the image capturing sub-unit 103 is changed up to 180° by maintaining the same distance from the focused breast and pointed towards it. The infrared images are collected in seven different positions for each breast and one image is collected from each axilla. Then after some resting and reducing two to three-degree ambient temperature another set (Second set) of data has been collected. Total 32 images are collected for two sets of ambient temperature for each subject this procedure is named as Dynamic temperature data collection.

[0042] The subject sit in a fixed position and the image capturing sub-unit 103 moves in a circular way on an arm based arrangement. Infra-red imaging of only one breast is done at a time and the other breast is covered behind the infra-red proof wall 105.

[0043] In figure 4, images are captured at a difference of 0°, 30°, 60°, 90°, 120°, 150°, 180° and axilla. This process is repeated for the other breast at the same temperature.

[0044] The captured images are then processed in the computer 104 via. a dedicated software. Breasts with malignant tumours have higher temperature than breasts with benign tumour and healthy one. The dedicated software detects the features of hottest regions of abnormal breasts which are termed as “suspected regions” using Color based segmentation of infrared thermal images. The imaging has been done in two different ambient temperatures to extract the dynamic nature of thermo gram due to angiogenesis in malignant breast. The extracted features are trained using machine learning algorithms to achieve the normal and abnormal prediction on a particular viewing angle.

[0045] The proposed system 100 has been used for 107 subjects. The accuracy of the system 100 is found to be 92.52 % for screening of breast abnormality and detecting malignancy so far.

[0046] The proposed rotational thermo-graphic imaging based breast cancer screening system 100 works in non-contact way and provide best comfort to the subject in sitting position. Further, the proposed system 100 takes images in a thermally controlled at different temperatures to extract the dynamic nature of thermo gram due to angiogenesis in malignant breast.

[0047] It will be understood by those within the art that, in general, terms used herein, and especially in the appended claims (e.g., bodies of the appended claims) are generally intended as “open” terms (e.g., the term “including” should be interpreted as “including but not limited to,” the term “having” should be

interpreted as “having at least,” the term “includes” should be interpreted as “includes but is not limited to,” etc.). It will be further understood by those within the art that if a specific number of an introduced claim recitation is intended, such an intent will be explicitly recited in the claim, and in the absence of such recitation no such intent is present. For example, as an aid to understanding, the following appended claims may contain usage of the introductory phrases “at least one” and “one or more” to introduce claim recitations. However, the use of such phrases should not be construed to imply that the introduction of a claim recitation by the indefinite articles “a” or “an” limits any particular claim containing such introduced claim recitation to inventions containing only one such recitation, even when the same claim includes the introductory phrases “one or more” or “at least one” and indefinite articles such as “a” or “an” (e.g., “a” and/or “an” should typically be interpreted to mean “at least one” or “one or more”); the same holds true for the use of definite articles used to introduce claim recitations. In addition, even if a specific number of an introduced claim recitation is explicitly recited, those skilled in the art will recognize that such recitation should typically be interpreted to mean at least the recited number (e.g., the bare recitation of “two recitations,” without other modifiers, typically means at least two recitations, or two or more recitations). Furthermore, in those instances where a convention analogous to “at least one of A, B, and C, etc.” is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., “a system having at least one of A, B, and C” would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). In those instances where a convention analogous to “at least one of A, B, or C, etc.” is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., “a system having at least one of A, B, or C” would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). It will be further understood by those within the art that virtually any disjunctive word and/or phrase presenting two or more alternative

terms, whether in the description, claims, or drawings, should be understood to contemplate the possibilities of including one of the terms, either of the terms, or both terms. For example, the phrase “A or B” will be understood to include the possibilities of “A” or “B” or “A and B.”

[0048] It will be further appreciated that functions or structures of a plurality of components or steps may be combined into a single component or step, or the functions or structures of one-step or component may be split among plural steps or components. The present invention contemplates all of these combinations. Unless stated otherwise, dimensions and geometries of the various structures depicted herein are not intended to be restrictive of the invention, and other dimensions or geometries are possible. In addition, while a feature of the present invention may have been described in the context of only one of the illustrated embodiments, such feature may be combined with one or more other features of other embodiments, for any given application. It will also be appreciated from the above that the fabrication of the unique structures herein and the operation thereof also constitute methods in accordance with the present invention. The present invention also encompasses intermediate and end products resulting from the practice of the methods herein. The use of “comprising” or “including” also contemplates embodiments that “consist essentially of” or “consist of” the recited feature.

We Claim:

1. A rotational thermo-graphic imaging based breast cancer screening system (100), the system (100) comprises:

a temperature controlled enclosure (101) having an adjustable grooved hole (102) in the front wall (105) to accommodate one breast, wherein a set temperature is maintained by an air-conditioning unit controller (301);

10 an image capturing sub-unit (103), provided in the temperature controlled enclosure (101), to capture thermo-graphic images of the breast accommodated in the adjustable grooved hole (102) of the temperature controlled enclosure (101), the image capturing sub-unit (103) comprising an Infra-red camera (106) provided at an end of a rotating arm (107) to facilitate capturing of the thermo-graphic image of breast from different angles and from both axilla;

15 a computer (104), electronically connected to the image capturing sub-unit (103) and air conditioning unit controller (301), to operate the movement of the image capturing sub-unit (301) and capturing the thermo-graphic images from different angles, wherein the captured image is analysed for detection of abnormalities of the breast at each angle.

- 20
2. The system (100) as claimed in claim 1, wherein movement of the image capturing sub-unit (103) is controlled using a motor controller (201) configured to be operated via the computer (104).
 - 25 3. The system (100) as claimed in claim 2, wherein the image capturing sub-unit (103) preferably move in a semi-circular path, with adjustable grooved hole (102) as center, to capture the thermo-graphic images of the breast from different angles and from both axilla.

4. The system (100) as claimed in claim 1, wherein the image capturing sub-unit (103) rotates, such that, the distance between the IR camera (106) and the adjustable grooved hole (102) in the temperature controlled enclosure (101), where breast is accommodated, remains constant resulting in focusing of the IR camera (106) on the adjustable grooved hole (102).
5
5. The system (100) as claimed in claim 4, wherein the distance between the IR camera (106) and the adjustable grooved hole (102) in the temperature controlled enclosure (101), where breast is accommodated, depends on the minimal focus distance of the IR camera (106).
- 10 6. The system (100) as claimed in claim 1, wherein at least two set of images from different angles and both axilla are taken, each set being taken at different temperature, to extract the dynamic nature of thermo gram due to angiogenesis in malignant breast.
- 15 7. The system (100) as claimed in claim 1, wherein the temperature of the room where the system (100) is kept is maintained at a constant temperature via an external air conditioning unit (301).
8. The system (100) as claimed in claim 1, wherein the adjustable grooved hole (102) is preferably semi-circular.
- 16 9. The system (100) as claimed in claim 1, wherein the adjustable grooved hole (102) is made adjustable to different size of breast by providing different templates.
20
10. The system (100) as claimed in claim 1, wherein a table top mechanical arrangement is provided in the system to facilitate capturing of thermo-graphic image of one breast at a time by covering the other breast behind an infra-red proof wall (105).
25
11. The system (100) as claimed in claim 1, wherein a temperature sensor (302) is placed inside the temperature controlled enclosure (101) to

provide the temperature of the enclosure to the air conditioning unit controller (301).

12. The system (100) as claimed in claim 1, wherein the air conditioning unit controller (301) controls an internal air conditioning unit (303) provided on the temperature controlled enclosure (101) based on the temperature provided by the temperature sensor (302) to maintain constant temperature inside the temperature controlled enclosure (101).

Dated this 24th day of august, 2020

10



**SAURABH VAID
IN/PA-1814
AT L. S. DAVAR & CO.
APPLICANT'S AGENT**

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20

25

ABSTRACT

“A ROTATIONAL THERMO-GRAFIC IMAGING BASED BREAST CANCER SCREENING SYSTEM”

The present subject matter relates to a rotational thermo-graphic imaging based
5 breast cancer screening system 100. The breast cancer screening system 100 comprises a temperature controlled enclosure 101 with adjustable groove hole 102, an air conditioning unit controller 301, an image capturing sub-unit 103 and a computer 104. The adjustable groove hole 102 is provided in the front wall 105 of the temperature controlled enclosure 101 to accommodate one breast. In the
10 temperature controlled enclosure 101, a set temperature is maintained by the air conditioning unit controller 301. The image capturing sub-unit 103 is provided in the temperature controlled enclosure 101 to capture thermo-graphic image of the breast accommodated in the adjustable grooved hole 102 of the temperature controlled enclosure 101. The computer 104 is electronically connected to the
15 image capturing sub-unit and air conditioning unit controller 301 to operate the movement of the image capturing sub-unit 103 and capturing the thermo-graphic images from different angles. The thermo-graphic images are analyzed for detection of abnormality of the breast at each angle.

TO BE PUBLISHED WITH FIGURE 1



**INTELLECTUAL
PROPERTY INDIA**

एकास्व/PATENTS | अभिकल्प/DESIGNS |
व्यापार चिह्न/TRADE MARKS | भौगोलिक
उपदर्शन/GEOGRAPHICAL INDICATIONS



भारत सरकार
GOVERNMENT OF INDIA

एकास्व कार्यालय/THE PATENT OFFICE
बौद्धिक सम्पदा भवन/I.P.O. BUILDING
सी.पी. 2, सेक्टर V/ CP-2, Sector V,
सॉलट लेक सिटी/Salt Lake City
कोलकाता/ Kolkata- 700091
दूरभाष / Tel. No.: (091)(033)223679101
फैक्स / Fax : 033- 23671988
ई-मेल/ Email : kolkata-patent@nic.in
वेबसाइट /Website: <http://ipindia.nic.in>

सं.। No. 202031036632

दिनांक। Dated the 28/06/2024

सेवा मे,। To :

Address of Service:- L.S.DAVAR & CO., GLOBSYN CRYSTALS, TOWER 1, 2ND FLOOR, BLOCK EP, PLOT NO. 11 &12, SALT LAKE SECTOR V, KOLKATA – 700 091, WEST BENGAL, INDIA
Email Id:- delhi@lsdavar.in, mailsdelhi@lsdavar.in

विषय :- पेटेंट आवेदन संख्या 202031036632 के संबंध मे अधिनियम की धारा 43 के तहत पेटेंट अनुदान तथा पेटेंट रजिस्टर मे प्रविष्टि की सूचना

Sub :- Intimation of the grant and recordal of patent under section 43 of the Act in respect of patent application no. 202031036632

महोदय/महोदया,

Sir/Madam,

आपको सूचित किया जाता है कि पेटेंट अधिनियम, 1970 की धारा 12 व 13 तथा उस आधार पर बने नियम के तहत उपर्युक्त पेटेंट आवेदन के परीक्षण [व 17/05/2024 को हुई सुनवाई] के उपरांत एतद्वारा पेटेंट अनुदान किया जाता है। तथा पेटेंट अनुदान की प्रविष्टि 28/06/2024 को पेटेंट रजिस्टर मे कर दी गयी है।

This is to Inform you that following the examination of above mentioned patent application under section 12 and 13 of The Patents Act, 1970 and Rules made thereunder [and hearing held on 17/05/2024] a patent is hereby granted and recorded in the Register of Patents on the 28/06/2024. The Patent Certificate is enclosed herewith.

पेटेंट संख्या। Patent No : 543617

आवेदक का नाम। Name Of Applicant : CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING

पेटेंट दिनांक। Date of Patent : 25/08/2020

पूर्विका तिथि। Priority Date : 25/08/2020

परीक्षण हेतु अनुरोध दाखिल करने की तिथि। Filling date of Request for examination : 02/11/2021

शीर्षक। Title : A ROTATIONAL THERMO-GRAPHIC IMAGING BASED BREAST CANCER SCREENING SYSTEM

दावों की संख्या। Number of claims : 12

Controller' Name : Devendra Kumar Deshmukh

Controller' Email : deshmukhd.ipd@gov.in

Controller' Location : Kolkata

उपर्युक्त पेटेंट के अनुदान का प्रकाशन अधिनियम की धारा 43 के तहत पेटेंट कार्यालय के आधिकारिक जर्नल मे किया जाएगा।

The grant of above mentioned patent will be published in the Official Journal of the patent Office under section 43 of the Act.

पेटेंट अधिनियम 1970 यथा संशोधित पेटेंट (संशोधन) नियम, 2005/ पेटेंट नियम, 2003 यथा संशोधित पेटेंट (संशोधन) नियम, 2016 की धारा 142 की उप-धारा (4) के ग्रावधानों के तहत उपरोक्त प्रविष्टि की तिथि से 3 माह के भीतर इस कार्यालय मे नवीकरण शुल्क जमा किया जाना चाहिए।

The payment of renewal fee is required to be made at this office within three(3) months from the aforesaid date of recording according to the proviso in sub-section(4) of Section 142 of The Patents Act,1970, as amended by The Patents (Amendment) Act, 2005 / The Patents Rules, 2003 as amended by The Patents (Amendment) Rules, 2016.

Devendra Kumar Deshmukh

(नियंत्रक पेटेंट)

Controller of Patents

टिप्पणी। Note :

1. संशोधित नवीकरण शुल्क हेतु कृपया महानियंत्रक पेटेंट, अभिकल्प एवं व्यापार चिह्न की आधिकारिक वेबसाइट www.ipindia.gov.in पर उपलब्ध पेटेंट (संशोधन) नियम 2016 की प्रथम अनुसूची (शुल्क) देखें।

For revised renewal fees kindly refer to the First Schedule (fees) of The Patents (Amendment) Rules 2016 available on the official website of Controller General of Patents, Designs and Trade Marks www.ipindia.gov.in

2. कार्यालय द्वारा पेटेंट प्रमाणपत्र की कोई भी कागजी प्रति अलग से जारी नहीं की जाएगी।

No hard copy of Patent Certificate shall be issued separately by the office.



Date: May 28, 2024

Controller of Patents & Designs : **Shri Devendra Kumar Deshmukh**
Letter Ref. : **Application No/ 202031036632**
Date of Hearing : **17/05/2024**

The Controller of Patents
Patent Office Branch
Intellectual Property Office Building,
Kolkata

Re: Indian Patent Application No.: **202031036632** dated **25/08/2020** in the name of **CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING**

Respected Sir,

We write in response to the Hearing Notice dated **April 18, 2024**, and the Hearing held on **May 17, 2024**. Our response to the objections raised in the Hearing Notice is as follows:

Formal Requirement(s)

The Applicant submits that, as discussed during the hearing, a fresh Form-1 has been filed in response to a formal requirement under ‘Other Deficiency’ raised on Page 5 of the FER. This is not a voluntary amendment, and therefore, a Form-13 is not required.

Accordingly, the Controller is requested to reconsider and waive the objection.

Non-Patentability u/s 3

The Applicant respectfully disagrees with the Controller’s view and submits that the claims of the present invention do not fall within the scope of Sections 3(k) of the Patents Act, 1970.

In this regard, the Applicant would like to draw the attention of the Controller to the Revised CRI guidelines released in 2017, wherein it is clearly stated that **while establishing patentability, the focus should be on the underlying substance of the invention and not on the particular form in which it is claimed**. What is important is to judge the substance of claims by taking the whole of the claim together. [Emphasis added]

Further, the Applicant has stated various tests and relevant case laws to support the arguments presented.

At the outset, the Applicant submits that, as discussed during the hearing, the claimed invention provides a technical solution to the technical problems with the conventional arts (as discussed in the background section of the as-filed specification).

For example, as stated in paras 003-006 of the as-filed specification, in one of the conventional arts, an infrared camera is placed at a distance so that the front view of both breasts ("objects") is visible in the camera field of view (FOV). It was not possible to get complete imaging of each object by this imaging technique as it was not able to capture object images from all the viewing angles. In another conventional art, multiple cameras were attached to get both the object images individually. These techniques have disadvantages in distinguishing between foreground and background where one object acts as foreground and other object acts as background. In another conventional art, the subject was rotated on a rotational chair or stool keeping the IR Camera fixed. In that case, focusing the object in the FOV of the camera has to be done each time as the distances from the camera to the focus point vary from one angle to another angle with different rotational positions of the body which is a cumbersome process. Similarly, the same problem remains if the camera is rotated and the subject is fixed while the camera is focused with respect to the body instead of the object. In other conventional art, some different body positioning like a prone position where the camera is placed underneath a table where an object hangs through a hole in the table but this position is uncomfortable for the patients.

The Applicant submits that the claimed invention discloses a rotational thermographic imaging based breast cancer screening system (100).

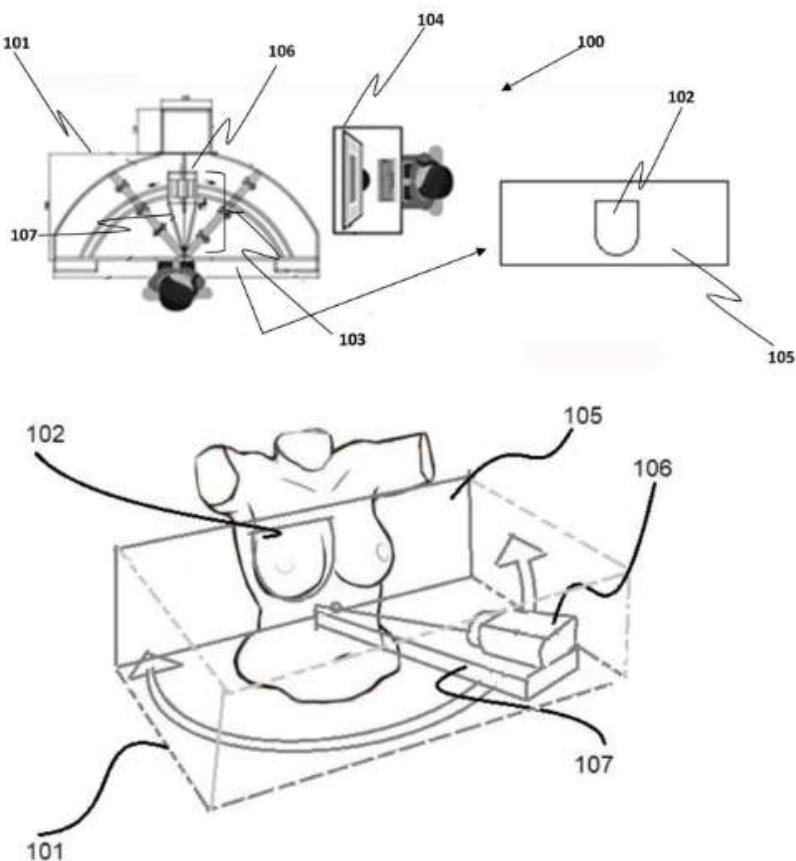


Figure 1

The system (100) includes a temperature controlled enclosure (101), an image capturing sub-unit (103), and a computer (104). The temperature controlled enclosure (101) includes an adjustable grooved hole (102) in the front wall (105) to accommodate one breast ("object") of a patient ("subject"). A set temperature of the temperature controlled enclosure (101) is maintained by an air-conditioning unit controller (301). The image capturing sub-

unit (103) is provided in the temperature-controlled enclosure (101), to capture thermo-graphic images of the object accommodated in the adjustable grooved hole (102) of the temperature-controlled enclosure (101). The image capturing sub-unit (103) includes an infra-red camera (106) provided at an end of a rotating arm (107) to facilitate capturing of the thermo-graphic image of the object from different angles and from both axilla. The computer (104) is electronically connected to the image capturing sub-unit (103) and the air conditioning unit controller (301). The computer (104) operates the movement of the image capturing sub-unit (301) and captures the thermo-graphic images of the object from different angles. The captured image is analysed for the detection of abnormalities of the object at each angle.

The Applicant further submits that the claimed invention recites various computer hardware entities, for example, an air-conditioning unit controller (301), an image capturing sub-unit (103), an infra-red camera (106), and a computer (104), etc.; and the same is amply supported in the as-filed specification, for example at least in **Figures 1-3** (its corresponding description). It is submitted that a person skilled in the art will understand that the above-mentioned entities are the **structural/constructional/physical/inventive** components or features of the claimed invention that necessarily include electronic circuits.

The Applicant would like to draw the attention of the learned Controller to a well-settled principle of law as held in the **Hon'ble Delhi High Court in the case of Ericsson vs. Lava**

(See Paragraphs 89-94 given below), wherein it was held that inventions which result in technical advancement and have practical implementation or physical representation are patentable.

*“...Each of the inventions claimed in the suit patent are **not mere theoretical or abstract algorithms** or mere mathematical or mental methods or even computer programmes per se as*

is being alleged by defendant. Inventions which have resulted in an improvement (technical advancement) in data communication technologies and have had a huge effect upon the manner in which these technologies function thereby resulting in practical implementation and actual physical representation.

*... Mere mention of an algorithm or a mathematical formula in a patent document should not
be inferred to mean that the invention is nothing but an algorithm.....*

*.... A bare perusal of the complete specification of all the 8 suit patents would *prima facie* reveal that the same actually relate to devices/apparatuses/components/mobile stations etc. and are thus, product patents which cannot be labelled as **algorithm which is nothing but a set of instructions and is thus, theoretical in nature....”***

From the above judicial precedents, the following can be gathered:

- *An algorithm is a theoretical construct, and which does not have any practical implementation or realization; and*
- *Section 3(k) provides a bar only for the inventions that are abstract in nature.*

In light of the above decisions, it can be drawn that an **algorithm is a theoretical construct which exists only on paper and which does not have any practical implementation or realization.** However, the present invention has a physical presence and **real-world implementation**, for example, the present invention can be implemented in the processors.

The Hon’ble IPAB has previously held in many cases that the computer-related invention that **achieves a technical effect** whether by means of **hardware or software cannot** be regarded as a **computer program per se**. This position has also been confirmed by the Hon’ble Delhi High Court in the case of **Ericsson vs. Intex** (See Paragraphs 119 and 120), wherein the legislative intent was considered, and it was accordingly held that:

*“In fact, when this bill was referred to the Joint Parliamentary Committee, it was suggested by various experts and stake holders that India should follow the EU/UK route and not completely exclude computer program from patentability. The Parliament after accepting the aforesaid proposition added the words *per se* which was introduced in Section 3(k) enacted by the Patent (Amendment) Act, 2002.*

Thus, it appears to me prima facie that any invention which has a technical contribution or has a technical effect and is not merely a computer program per se as alleged by the defendant and the same is patentable.....”

In connection to the above, the **Hon’ble Delhi High Court in the case of Ferid Allani vs Union of India** held that a computer-related invention demonstrating a ‘technical effect’ or a ‘technical contribution’ is patentable even though it may be based on a computer program. The court discussed the legislative history behind the inclusion of the words ‘**per se**’ in Section 3(k) on the recommendation of the Joint Parliamentary Committee. The Court also deliberated upon the legal position in the EU which has a similar provision in Article 52 of EPC. Recognizing the role of software in modern-day inventions, the court stated that:

“In today’s digital world, when most inventions are based on computer programs, it would be retrograde to argue that all such inventions would not be patentable. Innovation in the field of artificial intelligence, block-chain technologies and other digital products would be based on computer programs, however the same would not become non-patentable inventions –

simply for that reason. It is rare to see a product which is not based on a computer program. Whether they are cars and other automobiles, microwave ovens, washing machines, refrigerators, they all have some sort of computer programs in-built in them. Thus, the effect that such programs produce including in digital and electronic products is crucial in determining the test of patentability. Patent applications in these fields would have to be examined to see if they result in a ‘technical contribution’.”

In the end, the Court held that across the world, patent offices have tested patent applications in this field of innovation, on the fulcrum of ‘technical effect’ and ‘technical contribution’. **If any invention demonstrates a ‘technical effect’ or a ‘technical contribution’, it is patentable even though it may be based on a computer program.** (Refer to Paragraphs 10 to 13)

.....
.....

Therefore, from the above judicial precedents, *it can be gathered that if the present invention provides a technical solution to a technical problem and has a technical effect then the same cannot be considered to fall under the category of algorithm or computer program per se.*

Further, the Hon’ble IPAB in the case of **ALLANI FERID v. Assistant Controller of Patent (OA/17/2020/PT/DEL)** held that while examining the patentability of the subject matter it is a must to appreciate the technical effect produced by the present invention. The mere fact that a computer program is used for effectuating a part of the present invention, does not provide

a bar to patentability. Thus, the invention must be examined as a whole, and the following factors are to be considered while deciding upon the patentability of such inventions – i.e. (i) the technical effect achieved by it, and its (ii) technical contribution. (see para 33 of the order)

The Hon'ble Board also affirmed the list of examples of technical effect given in CRI guidelines, 2013 issued by the Office of the Controller General of Patents, and held that if any invention provides any technical effect mentioned in CRI guidelines, 2013, it belongs to a patentable subject matter. (see para 39 of the order) The lists of examples of technical effects are:

- i. Higher speed
- ii. Reduced hard-disk access time
- iii. More economical use of memory
- iv. More efficient data base search strategy
- v. More effective data compression techniques
- vi. Improved user interface
- vii. Better control of robotic arm
- viii. Improved reception/transmission of a radio signal

Therefore, from above all judicial precedents, it is well settled now that if the invention demonstrates **technical effect or provides a technical contribution, then it is a patentable subject matter.** To this end, the Applicant submits that the present invention also provides a technical solution to a technical problem and has a technical effect.

Technical Problem

The **technical problem** solved by the present invention can be formulated as “*how to get complete imaging of the breasts of a patient in a non-contact or non-invasive way and at little discomfort to the patient, in order to detect breast cancer.*”

Technical Solution

The said technical problem is solved by the claimed features, particularly by the whole features as claimed at least in claims 1-12 of the present disclosure.

Technical Effects

The **technical effect** achieved due to the differentiating technical features is that *it provides complete imaging of the breast at little discomfort and in a non-contact way.*

Therefore, from above it can be concluded that the present invention in the pending claims provides **technical solutions** concerned with the above-mentioned **technical problem** exhibiting **technical contributions/effects.**

Now if the Controller is of the assumption that the claimed invention is performed without novel/inventive hardware.

In this regard, the Applicant would like to bring to the notice of the Controller to the **IPAB order in Accenture Global Service GmbH v/s Asst. Controller of Patents and Designs** (order No. 282/2012 dated December 28th, 2012) case, wherein the Hon'ble IPAB while remanding back the matter to the Patent Office stated that the following standards are based on ill-founded premises and far from being logical and reasonable.

- “1. A hardware implementation performing a novel function is not patentable if that particular hardware is known or is obvious irrespective of the function performed.*
- 2. If the novel features of the invention resides in a set of instructions (programme) designed to cause the hardware to perform the desired operations without special adoption of the hardware or modification of the hardware, then the matter claimed either alone or in combination is not patentable.”*

Once the Accenture case was remanded back to the Patent Office for re-assessment, they had to allow the patent application involved therein. The reasoning for allowance given in the **Controller's decision** by the Patent Office itself was as follows:

“the invention as claimed is not software per se but, a system is claimed which is having the improvement in web services and software the invention since not falling in the category of Section 3(K), viz software per se, objection is waived and patent is granted”

In addition, the Applicant relies upon the **Hon'ble Delhi High Court in the case of Microsoft Tech. Licensing, LLC v. Controller General of Patents and Designs (2023:DHC:3342)** which settled the position regarding the patentability of CRI. It observed that the insertion of words ‘per se’ means that “computer programs as such” are nonpatentable. However, if a computer program is used in conjunction with hardware or results in a technical effect/solves a technical problem, it may be eligible for patent protection. Further, the Court clarified that the focus in the 2017 CRI Guidelines is on the **substance** of the claims over the forms of the claims. The judgement as regards Sec. 3(k) is:

“If a computer-based invention provides a technical effect or contribution, it may still be patentable. The technical effect or contribution can be demonstrated by showing that the invention solves a technical problem, enhances a technical process, or has some other technical benefit. The mere fact that an invention involves a mathematical or computer-based method does not automatically exclude it from being patentable. The invention can still satisfy the patentability requirements, including the requirement for a technical effect or contribution, to be eligible for patent protection. In other words, method claims in computer program patents may be patentable if it involves a technical advancement and provides a technical solution to a technical problem and has an improved technical effect on the underlying software....An invention should not be deemed a computer program per se merely because it involves algorithms and computer-executable instructions.”

The Applicant also relies upon the **Hon'ble Delhi High Court** in the case of **Raytheon Company v Controller General of Patents and Designs** (2023:DHC:6673), which

reaffirmed its judgments from Ferid Allani and Microsoft Technology Licensing and ruled that in cases of computer-related inventions, the technical contribution or effect that the invention generates is what needs to be examined. The Court opined that the requirement of including novel hardware features in claims has no basis in law. It also pointed out that the 2017 version of the guidelines does not impose any such requirement and the guidelines insist that in examination of computer related inventions, the focus should be on the substance of the claims and not on form or presentation.

In view of the above, it can be safely concluded that the presence of novel hardware is not mandatory for the patentability of computer-related inventions.

Further, the CRI guidelines published on June 30th, 2017, have removed the novel hardware requirement amongst other changes. The erstwhile three-step test for patentability (whose third step specifically stated that computer programs in themselves were unpatentable and could only be claimed in conjunction with novel hardware) has also been removed.

Accordingly, the Applicant respectfully submits that a person skilled in the art will understand that computer hardware components as described earlier above are constructional/structural limitations of the claims and are essential to carry out the claimed invention. The technical effect proposed by the present invention is achievable only when the structural/constructional components carry out the claimed invention. Hence, the claims should be considered as a whole. Also as discussed above, since novel hardware requirement is now removed in the case of the computer-related invention where technical effect/contribution can be demonstrated, it cannot be said that claims are directed toward a non-patentable subject matter.

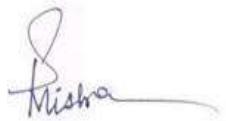
Therefore, the present invention in the pending claims does not fall in the category of nonpatentable subject matter u/s 3(k).

Accordingly, the Controller is respectfully requested to reconsider and withdraw the present objection.

In view of the above submissions, we humbly request the Controller to kindly accept this application and proceed to grant a patent. Also, please let us know if we are required to comply with any further requirements. However, before taking any adverse action, we humbly request the Controller to give the Applicant an opportunity of being heard u/s 14 of the Indian Patents Act, 1970.

We thank you in advance for your cooperation in this regard.

Yours sincerely,



SOMA RANI MISHRA
IN/PA – 1159
OF L. S. DAVAR & CO.,
APPLICANT'S AGENT

Encl: As above



Head Office:
Globsyn Crystals, Tower 1, 2nd
Floor, Block EP, Plot No. 11 & 12,
Salt Lake, Sector V, Kolkata – 700091
T: +91 (33) 2357 1010 | +91 (33) 2357 1020
F: +91 (33) 2357 1018 | +91 (33) 2357 1019
E: docketing@lsdavar.in | mailinfo@lsdavar.in

Delhi Office:
F-1/2, Okhla Industrial Area, Phase-I,
New Delhi-110020, India
T: +91 (11) 26811041 | +91 (11) 26811042
F: +91 (11) 26811043 |
E: mailsdelhi@lsdavar.in | delhi@lsdavar.in
Accounts : creditcontroller@lsdavar.in

Origin: DELHI

Dated 13th day of May, 2024

The Controller of Patents and Designs,
The Patent Office Branch,
Govt. of India,
India.

Kind Attn: Shri Devendra Kumar Deshmukh, Assistant Controller of Patents & Designs

Subject: Intimation for Attending the Hearing

Patent Application No.: **202031036632**

Filing Date: 25/08/2020

Applicant: **CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING**

Title: “A ROTATIONAL THERMO-GRAPHIC IMAGING BASED BREAST CANCER SCREENING SYSTEM”

Respected Sir/Ma’am,

This is with reference to the hearing notice dated 18/04/2024, received for the above-mentioned application.

We would like to inform you that we would be appearing for the hearing scheduled on **May 17, 2024 at 01:30 PM.**

Thanking you.

Yours Truly,

SOMA RANI MISHRA
IN/PA - 1159
L. S. DAVAR & CO.,
APPLICANT'S AGENT



**PATENT AND
TRADEMARK
ATTORNEYS**
L. S. DAVAR & CO.
ESTD. 1932 NEW DELHI • KOLKATA • BENGALURU
COMMITTED TO PROTECTING INNOVATIONS
www.lsdavar.org.in

Head Office:
Globsyn Crystals, Tower 1, 2nd
Floor, Block EP, Plot No. 11 & 12,
Salt Lake, Sector V, Kolkata – 700091
T: +91 (33) 2357 1010 | +91 (33) 2357 1020
F: +91 (33) 2357 1018 | +91 (33) 2357 1019
E: docketing@lsdavar.in | mailinfo@lsdavar.in
kolkatapatent@lsdavar.in

Delhi Office:
F-1/2, Okhla Industrial Area
Phase – 1, New Delhi - 110020
T: +91 (11) 2681 1041 | +91 (11) 2681 1042
F: +91 (11) 2681 1043
E: mailsdelhi@lsdavar.in | delhi@lsdavar.in

Origin: H.O.

Date: 13/05/2024

To
The Controller of Patents
The Patent Office
Kolkata

**Re: Indian Patent Application No.: 202031036632 dated 25/08/2020 in
the name of CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING**

Dear Sir/Ma'am,

With reference to the Hearing Notice dated 18/04/2024 (hearing on 17/05/2024) we submit herewith the following:

- Substitute Power of Authority authorizing AKHILESH KUMAR GUPTA (IN/PA – 1303).

Yours Sincerely,

SOMA RANI MISHRA
IN/PA – 1159
OF L. S. DAVAR & CO.,
APPLICANT'S AGENT

/tkb



MAY-13-2024 16:58:27
₹ 0000100/-
ZERO ZERO ZERO ONE ZERO ZERO
Agreement
38162131716618607932-00013660
3816213 WB/Ces/Auth/PB-169

THE PATENTS ACT, 1970

SUBSTITUTE SPECIFIC POWER OF AUTHORITY

I, SOMA RANI MISHRA (IN/PA-1159), of Globsyn Crystals, Tower 1, 2nd Floor, Block EP, Plot No. 11 & 12, Salt Lake Sector V, Kolkata – 700 091, India, an Indian Citizen, belonging to the firm M/s. L.S. DAVAR & CO., Patent & Trademarks Attorneys, hereby authorize:

AKHILESH KUMAR GUPTA (IN/PA – 1303), an Indian Citizen and Registered Patent Agent of L.S. DAVAR & CO., to act on behalf of the Applicant (s) in respect of Indian Patent Application No.: 202031036632 dated 25/08/2020 for securing from the Government of Indian Letters Patents under the Patents Act in respect of the invention claimed in the above referred case and in all matters and proceedings before the Controller of Patents or the Government of India in connection therewith or incidental thereto and in all matters and proceedings subsequent to the grant of such Letters of Patent.

Dated this 13th day of May, 2024

**SOMA RANI MISHRA
IN/PA – 1159
OF L. S. DAVAR & CO.,
APPLICANT'S AGENT**

PATENT OFFICE
INTELLECTUAL PROPERTY BUILDING
Cp-2, Sector V, Salt Lake City, Kolkata-700091
Te No. (091)(033) 23671945-46, 87 FAX No. 033 23671988
E-mail : kolkata-patent@nic.in
Web Site : www.ipindia.gov.in



संदर्भ सं. / Ref. No:
POK/Application No /202031036632

प्रेषण दिनांक / Date of Dispatch:
18-04-2024

श्रेत्र मे. / To

आवेदक /Applicant:
CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING

Registered Address For Service :VAID SAURABH, L.S.DAVAR & CO., GLOBSYN CRYSTALS, TOWER 1, 2ND FLOOR, BLOCK EP, PLOT NO. 11 &12, SALT LAKE SECTOR V, KOLKATA – 700 091, WEST BENGAL, INDIA. Email: delhi@lsdavar.in,mailsdelhi@lsdavar.in

विपक्षी /Opponent:
NA

ई-मेल प्रेषित /Email Sent to:
delhi@lsdavar.in,mailsdelhi@lsdavar.in

तिथि: आवेदन संख्या 202031036632 के संदर्भ मे सुनवाई नोटिस
Sub: Hearing Notice in Reference of Application No. 202031036632

सुनवाई स्थल / Hearing Location: Through Video Conferencing
सुनवाई दिनांक व समय / Hearing Date & Time: 17/05/2024 / 13:30 HRS(IST) for (1h)
नियंत्रक ईमेल /Controller's EmailId: deshmukhd.ipo@gov.in

आपके द्वारा पूर्ण परीक्षण रिपोर्ट/ अनुपर्याप्त परीक्षण रिपोर्ट के उत्तर के संदर्भ मे, दिनांक 17/05/2024 को 13:30 HRS(IST) for (1h) बजे विडियो कॉनफ्रैंसिंग मामले मे Hearing U/S (14) सुनवाई तय की गयी है। अतः, आपको उपरोक्त दिनांक व समय पर नियंत्रक के समक्ष सुनवाई हेतु उपस्थिता होना है।

With reference to your reply to the First examination Report/Subsequent Examination Report, a Hearing U/S (14) hearing has been scheduled in the matter through Video Conferencing on 17/05/2024 at 13:30 HRS(IST) for (1h) . You are therefore, required to appear before the Controller for the hearing on said date and time.

इस आवेदन को पेटेंट अनुदान हेतु क्रम मे लाने की अंतिम तिथि से पूर्व / अंतिम तिथि के उपरान्त, निम्नलिखित आपत्तियां अभी भी शेष हैं।
The following objection(s) are still outstanding before / after the expiry of last date for putting this application in order for grant of patent.

Devendra Kumar Deshmukh
Assistant Controller of Patents & Designs

*दिनांक/समय, स्थल, रिथित व सुनवाई के बारे में अन्य विवरण के लिए: कृपया निम्नलिखित यूआरएल देखें <http://ipindiaservices.gov.in/PatentCauseList>
Please refer to the following URL for: Date/Time, Venue, Status and other details about the Hearing
<http://ipindiaservices.gov.in/PatentCauseList>

टिप्पणी:- विडियो कॉनफ्रैंसिंग के माध्यम से सुनवाई के समय के संबंध मे मैल अताग से भेजी जाएगी।

Note:- Separate mail will be sent regarding the time of the Hearing through Video Conference.

* Hearing Objections are attached.

Objections

Formal Requirement(s)

1. Form 13 shall be filed for updation of email address consistent with that filed in Form 1 on 09/11/2022 in Address for Service.

Non-Patentability u/s 3

1. Observations regarding reply to First Examination Report are carefully considered, but it doesn't meet office requirements.

The subject matter of amended claims 1-12 refers to a computer, electronically connected to the image capturing sub-unit and air conditioning unit controller, to operate the movement of the image capturing sub-unit and capturing the thermo-graphic images from different angles.

Thus it appears that the claims involve a "computer programme products" or "Storage Medium having instructions" or "Computer Memory with instructions stored in a computer readable medium" which are nothing but "computer programme per se" (Refer CRI Guidelines para 4.5.4).

Hence, the subject matter of the said claim 1-12 is not patentable u/s 3(k) of The Patents Act, 1970 (as amended).

We Claim:

1. A rotational thermo-graphic imaging based breast cancer screening system (100), the system (100) comprises:

a temperature controlled enclosure (101) having an adjustable grooved hole (102) in the front wall (105) to accommodate one breast, wherein a set temperature is maintained by an air-conditioning unit controller (301);

an image capturing sub-unit (103), provided in the temperature-controlled enclosure (101), to capture thermo-graphic images of the breast accommodated in the adjustable grooved hole (102) of the temperature-controlled enclosure (101), the image capturing sub-unit (103) comprising an infra-red camera (106) provided at an end of a rotating arm (107) to facilitate capturing of the thermo-graphic image of breast from different angles and from both axilla; and

a computer (104), electronically connected to the image capturing sub-unit (103) and air conditioning unit controller (301), to operate the movement of the image capturing sub-unit (301) and capturing the thermo-graphic images from different angles, wherein the captured image is analysed for detection of abnormalities of the breast at each angle.

2. The system (100) as claimed in claim 1, wherein movement of the image capturing sub-unit (103) is controlled using a motor controller (201) configured to be operated via the computer (104).

3. The system (100) as claimed in claim 2, wherein the image capturing sub-unit (103) preferably move in a semi-circular path, with adjustable grooved hole (102) as center, to capture the thermo-graphic images of the breast from different angles and from both axilla.

4. The system (100) as claimed in claim 1, wherein the image capturing sub-unit (103) rotates, such that, the distance between the IR camera (106) and the adjustable grooved hole (102) in the temperature controlled enclosure (101), where breast is accommodated, remains constant resulting in focusing of the IR camera (106) on the adjustable grooved hole (102).

5. The system (100) as claimed in claim 4, wherein the distance between the IR camera (106) and the adjustable grooved hole (102) in the temperature controlled enclosure (101), where breast is accommodated, depends on the minimal focus distance of the IR camera (106).

6. The system (100) as claimed in claim 1, wherein at least two sets of images from different angles and both axilla are taken, each set being taken at two different temperatures, to extract the dynamic nature of thermo gram due to angiogenesis in malignant breast.

7. The system (100) as claimed in claim 1, wherein the temperature of the room where the system (100) is kept is maintained at a constant temperature via an external air conditioning unit controller (301).

8. The system (100) as claimed in claim 1, wherein the adjustable grooved hole (102) is preferably semi-circular.

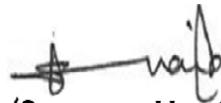
9. The system (100) as claimed in claim 1, wherein the adjustable grooved hole (102) is made adjustable to different size of breast by providing different templates.

10. The system (100) as claimed in claim 1, wherein a table top mechanical arrangement is provided in the system to facilitate capturing of thermo-graphic image of one breast at a time by covering the other breast behind an infra-red proof wall (105).

11. The system (100) as claimed in claim 1, wherein a temperature sensor (302) is placed inside the temperature controlled enclosure (101) to provide the temperature of the enclosure to the air conditioning unit controller (301).

12. The system (100) as claimed in claim 1, wherein the air conditioning unit controller (301) controls an internal air conditioning unit (303) provided on the temperature controlled enclosure (101) based on the temperature provided by the temperature sensor (302) to maintain constant temperature inside the temperature controlled enclosure (101).

Dated this 25th day of August, 2020



**SAURABH VAID
PATENT AGENT
IN/PA – 1814
OF L. S. DAVAR & CO.,
APPLICANT'S AGENT**

We Claim:

1. A rotational thermo-graphic imaging based breast cancer screening system (100), the system (100) comprises:

a temperature controlled enclosure (101) having an adjustable grooved hole (102) in the front wall (105) to accommodate one breast, wherein a set temperature is maintained by an air-conditioning unit controller (301);

an image capturing sub-unit (103), provided in the temperature controlledtemperature-controlled enclosure (101), to capture thermo-graphic images of the breast accommodated in the adjustable grooved hole (102) of the temperature controlledtemperature-controlled enclosure (101), the image capturing sub-unit (103) comprising an infra-red camera (106) provided at an end of a rotating arm (107) to facilitate capturing of the thermo-graphic image of breast from different angles and from both axilla; and

a computer (104), electronically connected to the image capturing sub-unit (103) and air conditioning unit controller (301), to operate the movement of the image capturing sub-unit (301) and capturing the thermo-graphic images from different angles, wherein the captured image is analysed for detection of abnormalities of the breast at each angle.

2. The system (100) as claimed in claim 1, wherein movement of the image capturing sub-unit (103) is controlled using a motor controller (201) configured to be operated via the computer (104).

3. The system (100) as claimed in claim 2, wherein the image capturing sub-unit (103) preferably move in a semi-circular path, with adjustable grooved hole (102) as center, to capture the thermo-graphic images of the breast from different angles and from both axilla.

4. The system (100) as claimed in claim 1, wherein the image capturing sub-unit (103) rotates, such that, the distance between the IR camera (106) and the adjustable grooved hole (102) in the temperature controlled enclosure (101), where breast is accommodated, remains constant resulting in focusing of the IR camera (106) on the adjustable grooved hole (102).

5. The system (100) as claimed in claim 4, wherein the distance between the IR camera (106) and the adjustable grooved hole (102) in the temperature controlled enclosure (101), where breast is accommodated, depends on the minimal focus distance of the IR camera (106).

6. The system (100) as claimed in claim 1, wherein at least two sets of images from different angles and both axilla is are taken, each set being taken at two different temperatures, to extract the dynamic nature of thermo gram due to angiogenesis in malignant breast.

7. The system (100) as claimed in claim 1, wherein the temperature of the room where the system (100) is kept is maintained at a constant temperature via an external air conditioning unit controller (301).

8. The system (100) as claimed in claim 1, wherein the adjustable grooved hole (102) is preferably semi-circular.

9. The system (100) as claimed in claim 1, wherein the adjustable grooved hole (102) is made adjustable to different size of breast by providing different templates.

10. The system (100) as claimed in claim 1, wherein a table top mechanical arrangement is provided in the system to facilitate capturing of thermo-graphic image of one breast at a time by covering the other breast behind an infra-red proof wall (105).

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11. The system (100) as claimed in claim 1, wherein a temperature sensor (302) is placed inside the temperature controlled enclosure (101) to provide the temperature of the enclosure to the air conditioning unit controller (301).

12. The system (100) as claimed in claim 1, wherein the air conditioning unit controller (301) controls an internal air conditioning unit (303) provided on the temperature controlled enclosure (101) based on the temperature provided by the temperature sensor (302) to maintain constant temperature inside the temperature controlled enclosure (101).

Dated this 25th day of August, 2020

FORM 2

THE PATENTS ACT 1970

39 OF 1970

&

THE PATENT RULES 2003

COMPLETE SPECIFICATION

(SEE SECTIONS 10 & RULE 13)

1. TITLE OF THE INVENTION

**"A ROTATIONAL THERMO-GRAPHIC IMAGING BASED BREAST
CANCER SCREENING SYSTEM"**

2. APPLICANTS (S)

NAME	NATIONALITY	ADDRESS
CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING	Indian	Plot - E-2/1, Block-GP, Sector-V Salt Lake Electronics Complex Bidhannagar, Kolkata – 700091 West Bengal (India)

3. PREAMBLE TO THE DESCRIPTION

COMPLETE SPECIFICATION

The following specification particularly describes the invention and the manner
in which it is to be performed

A ROTATIONAL THERMO-GRAPHIC IMAGING BASED BREAST CANCER SCREENING SYSTEM

FIELD OF THE INVENTION

[001] The present disclosure, in general, relates to a breast cancer screening system and more particularly, to a rotational thermo-graphic imaging based breast cancer screening system.

BACKGROUND OF THE INVENTION

[002] Breast cancer is a major cause of mortality in women. One of the factors that influence the chances of curing a patient having breast cancer is early detection of the disease.

[003] Several breast cancer imaging techniques are used in worldwide in different studies. In most of the previous works, common technique for breast cancer screening using Infrared imaging and the images are collected in sitting position with subjects having two arms up. The Infrared camera is placed at a distance so that front view of both breasts is visible in the camera field of view (FOV). It is not possible to get complete imaging of each breast by this imaging technique as it is not able to capture breast image from all the viewing angles.

[004] Another technique for the same imaging is to use multiple camera attachments to get both the breast images individually. These techniques have some disadvantages in distinguishing between foreground and background where one breast acts as foreground and other breast acts as background.

[005] Another technique is used to collect the infrared images by rotating the subject on a rotational chair or stool keeping the IR Camera fixed, which has also same disadvantage in focusing. In that case focusing the breast in FOV of camera has to be done each time as the distances from camera to focus point varies from one angle to another angle with different rotational positions of the body which is a cumbersome process. The same problem remains if the camera is rotated and

subject is fixed while camera is focused with respect to the body instead of the breast.

[006] Another study shows some different body positioning like prone position where camera is placed underneath a table where breast hangs through a hole in the table but this position is uncomfortable by the patients. Further, it is also observed that most of the studies do not reflect integrated software for IR image analysis and reporting. Above constraints have been removed in our system.

[007] Therefore, there is a need to develop a rotational thermo-graphic imaging based breast cancer screening system which can obviate the drawbacks mentioned above.

OBJECT OF THE INVENTION

[008] It is therefore an object of the present invention, to solve the aforementioned and other drawbacks existing in the existingbreast cancer screening system.

[009] Another primary object of the present invention is to provide a rotational thermo-graphic imaging based breast cancer screening system for complete imaging of breast.

[0010] Yet another objective of the present invention is to provide a rotational thermo-graphic imaging based breast cancer screening system having a rotating camera arm.

[0011] Yet another object of the present invention is to provide a rotational thermo-graphic imaging based breast cancer screening system which provides best comfort to the subject in sitting position.

[0012] Yet another object of the present invention is to provide a rotational thermo-graphic imaging based breast cancer screening system which can operate in non-contact way.

[0013] Yet another object of the present invention is to provide a rotational thermo-graphic imaging based breast cancer screening system to take images at different temperatures.

[0014] Still yet another object of the present invention is to provide a rotational thermo-graphic imaging based breast cancer screening system to take images in thermally controlled environment.

SUMMARY OF THE INVENTION

[0015] One or more drawbacks of breast cancer screening system and additional advantages are provided through the rotational thermo-graphic imaging based breast cancer screening system as claimed in the present disclosure. Additional features and advantages are realized through the technicalities of the present disclosure. Other embodiments and aspects of the disclosure are described in detail herein and are considered to be a part of the claimed disclosure.

[0016] The present subject matter relates to a rotational thermo-graphic imaging based breast cancer screening system. The breast cancer screening system comprises a temperature controlled enclosure with adjustable groove hole, an air conditioning unit controller, an image capturing sub-unit and a computer. The adjustable groove hole is provided in the front wall of the temperature controlled enclosure to accommodate one breast. In the temperature controlled enclosure, a set temperature is maintained by the air conditioning unit controller. The image capturing sub-unit is provided in the temperature controlled enclosure to capture thermo-graphic image of the breast accommodated in the adjustable grooved hole of the temperature controlled enclosure. The image capturing sub-unit comprises an infra-red camera provided at an end of a rotating arm to facilitate capturing of the thermo-graphic image of breast from different angles and from both axilla. The computer is electronically connected to the image capturing sub-unit and air conditioning unit controller to operate the movement of the image capturing sub-unit and capturing the thermo-graphic images from different angles. The thermo-

graphic images are analyzed for detection of abnormality of the breast at each angle.

[0017] In an aspect, movement of the image capturing sub-unit is controlled using a motor controller configured to be operated via the computer.

[0018] In an aspect, the image capturing sub-unit preferably moves in a semi-circular path to capture the thermo-graphic images of the breast from different angles and from both axilla.

[0019] In an aspect, the image capturing sub-unit rotates, such that, the distance between the IR camera and the adjustable grooved hole in the temperature controlled enclosure, where breast is accommodated, remains constant resulting in focusing of the IR camera on the adjustable grooved hole.

[0020] In an aspect, the distance between the IR camera and the adjustable grooved hole in the temperature controlled enclosure, where breast is accommodated, depends on the minimal focus distance of the IR camera.

[0021] In an aspect, at least two set of images from different angles and both axilla are taken, each set being taken at different temperature, to extract the dynamic nature of thermo gram due to angiogenesis in malignant breast.

[0022] In an aspect, the temperature of the room where the system is kept is maintained at a constant temperature via an external air conditioning unit.

[0023] In an aspect, the adjustable grooved hole is preferably semi-circular.

[0024] In an aspect, the adjustable grooved hole is made adjustable to different size of breast by providing different templates.

[0025] In an aspect, a table top mechanical arrangement is provided in the system to facilitate capturing of thermo-graphic image of one breast at a time by covering the other breast behind an infra-red proof wall.

[0026] In an aspect, a temperature sensor is placed inside the temperature controlled enclosure to provide the temperature of the enclosure to the air conditioning unit controller.

[0027] In an aspect, the air conditioning unit controller controls an internal air conditioning unit provided on the temperature controlled enclosure based on the temperature provided by the temperature sensor to maintain constant temperature inside the temperature controlled enclosure.

[0028] In order to further understand the characteristics and technical contents of the present invention, a description relating thereto has been made with reference to the accompanying drawings. However, the drawings are illustrative only but not used to limit scope of the present subject matter.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

[0029] Further objects and advantages of this invention will be more apparent from the description when read in conjunction with accompanying drawings of exemplary embodiments of invention and wherein:

[0030] Figure 1 illustrates top view of present rotational thermo-graphic imaging based cancer screening system, according to one of the embodiment of present subject matter;

[0031] figure 2 illustrates block diagram of connections for rotating arm control and data collection by computer, according to one of the embodiment of present subject matter;

[0032] Figure 3 illustrates block diagram for room and system temperature control according to one of the embodiment of present subject matter;and

[0033] Figure 4 illustrating top view of the image capturing sub-unit at different position for IR imaging capturing according to one of the embodiment of present subject matter.

DETAILED DESCRIPTION OF THE INVENTION

[0034] The present invention discloses a rotational thermo-graphic imaging based breast cancer screening system 100.

[0035] Referring to Figure 1 illustrating top view of present rotational thermo-graphic imaging based cancer screening system 100, according to one of the embodiment of present subject matter. The rotational thermo-graphic imaging based cancer screening system 100 comprises a temperature controlled enclosure 101 having an adjustable grooved hole 102, an air conditioning unit controller, an image capturing sub-unit 103 and a computer 104. The temperature controlled enclosure 101 is set up on a table top to ensure convenience of subject to sit properly. The adjustable grooved hole 102 is provided on the front wall 105 of the temperature controlled enclosure 101 to accommodate one breast of subject. The shape of the adjustable grooved hole 102 is preferably semi-circular and can be adjusted to various sizes according to the requirements by using different templates. The adjusting nature of the adjustable grooved hole 102 facilitate good positioning for IR imaging and provide comfort to the subject during whole process. The front wall 105 of the temperature controlled enclosure 101 is made up of infra-red proof wall, so that, IR imaging of only one breast can be performed at a time.

[0036] The image capturing sub-unit 103 is provided in the temperature controlled enclosure 101 facing the adjustable grooved hole 102 to capture thermo-graphic images of the breast accommodated in the adjustable grooved hole 102. The image capturing sub-unit 103 comprises an infra-red camera 106 provided at end of a rotating arm 107 to facilitate capturing of the thermo-graphic images of the breast from different angles and from both axilla.

[0037] In the preferred embodiment, the rotating arm 107 of the image capturing sub-unit 103 move in a semi-circular path, with the adjustable grooved hole 102 as a center, to facilitate capturing of the thermo-graphic images of the breast from different angles and from both the axilla. This arrangement further maintains same

distance between the IR camera 106 and the adjustable grooved hole 102 in the temperature controlled enclosure 101 which results in focusing of the IR camera 106 on the adjustable grooved hole 102 where the breast of the subject is accommodated.

[0038] The distance between the IR camera 106 and the adjustable grooved hole 102 in the temperature controlled enclosure 101 depends on the minimal focus distance of the IR camera 106. This ensure clear images at each and every position.

[0039] Referring to Figure 2 illustrating block diagram of connections for rotating arm 107 control and data collection by computer 104, according to one of the embodiment of present subject matter. In the preferred embodiment, a motor controller 201 is provided to facilitate movement of the image capturing sub-unit 103. The motor controller 201 is electronically connected to the computer 104 to operate the image capturing sub-unit 103. The computer 104 act as a controller and controls the functioning, such as, movement and capturing of images as predetermined angles of the image capturing sub-unit 103. The captured images are further processed in the computer 104 via a software specially designed for the said purpose. The software is a proprietary copyrighted software of the applicant bearing registration number SW-12853/2019. The software analyze the captured images by executing a novel technique which is implemented in temperature-based area features for explainable AI in machine language techniques, pseudo color and clustering based IR image segmentation, thermal region of interest extraction using masking and color plot based representation for detection of abnormalities in thermo-graphic images of the breast at each angle.

[0040] Referring to figure 3 illustrating block diagram for room and system temperature control according to one of the embodiment of present subject matter. The temperature of the temperature controlled enclosure is controlled by the air conditioning unit controller 301. A temperature sensor 302 is employed inside the temperature controlled enclosure 101 to measure the temperature maintained

inside the enclosure 101. An internal air conditioning unit 303 is provided to raise or lower the temperature of the temperature controlled enclosure 101 based measurement provided by the sensor 302 and as per the requirement. The temperature inside the temperature controlled enclosure 101 is maintained constant while taking each set of thermo-graphic images at different angles. At least two set of images from different angles and both axilla are taken. Each set of the thermo-graphic images is taken at different temperature to extract the dynamic nature of thermo gram due to angiogenesis in malignant breast. Further, the temperature of the room where this system 100 is kept is also maintained at constant temperature via an external air conditioning unit.

WORKING OF THE SYSTEM

[0041] Referring to Figure 4 illustrating top view of the image capturing sub-unit 103 at different position for IR imaging capturing according to one of the embodiment of present subject matter. The temperature of the temperature controlled enclosure 101 is maintained at a specific temperature. The temperature of the room is also maintained at a specific temperature. The subject is to be seated in front of the system 100 and one breast is placed in the adjustable grooved hole 102. The size of the adjustable grooved hole 102 is adjusted using a suitable template for better comfort of the subject. The pivot point of the camera 106 focus is set at the adjustable grooved hole 102, so that the breast which is placed at the camera 106 FOV is always in same focal distance. The position of the image capturing sub-unit 103 is changed up to 180° by maintaining the same distance from the focused breast and pointed towards it. The infrared images are collected in seven different positions for each breast and one image is collected from each axilla. Then after some resting and reducing two to three-degree ambient temperature another set (Second set) of data has been collected. Total 32 images are collected for two sets of ambient temperature for each subject this procedure is named as Dynamic temperature data collection.

[0042] The subject sit in a fixed position and the image capturing sub-unit 103 moves in a circular way on an arm based arrangement. Infra-red imaging of only one breast is done at a time and the other breast is covered behind the infra-red proof wall 105.

[0043] In figure 4, images are captured at a difference of 0°, 30°, 60°, 90°, 120°, 150°, 180° and axilla. This process is repeated for the other breast at the same temperature.

[0044] The captured images are then processed in the computer 104 via. a dedicated software. Breasts with malignant tumours have higher temperature than breasts with benign tumour and healthy one. The dedicated software detects the features of hottest regions of abnormal breasts which are termed as “suspected regions” using Color based segmentation of infrared thermal images. The imaging has been done in two different ambient temperatures to extract the dynamic nature of thermo gram due to angiogenesis in malignant breast. The extracted features are trained using machine learning algorithms to achieve the normal and abnormal prediction on a particular viewing angle.

[0045] The proposed system 100 has been used for 107 subjects. The accuracy of the system 100 is found to be 92.52 % for screening of breast abnormality and detecting malignancy so far.

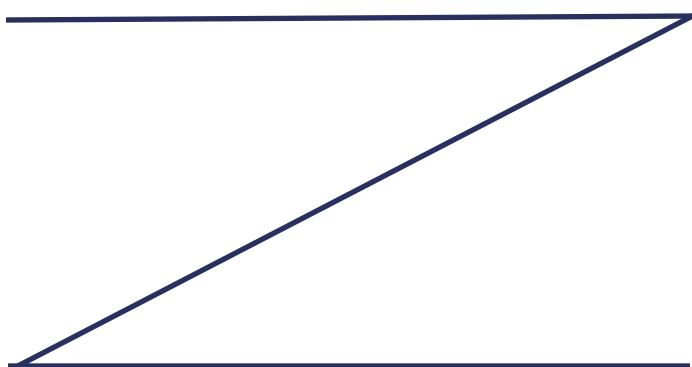
[0046] The proposed rotational thermo-graphic imaging based breast cancer screening system 100 works in non-contact way and provide best comfort to the subject in sitting position. Further, the proposed system 100 takes images in a thermally controlled at different temperatures to extract the dynamic nature of thermo gram due to angiogenesis in malignant breast.

[0047] It will be understood by those within the art that, in general, terms used herein, and especially in the appended claims (e.g., bodies of the appended claims) are generally intended as “open” terms (e.g., the term “including” should be interpreted as “including but not limited to,” the term “having” should be

interpreted as “having at least,” the term “includes” should be interpreted as “includes but is not limited to,” etc.). It will be further understood by those within the art that if a specific number of an introduced claim recitation is intended, such an intent will be explicitly recited in the claim, and in the absence of such recitation no such intent is present. For example, as an aid to understanding, the following appended claims may contain usage of the introductory phrases “at least one” and “one or more” to introduce claim recitations. However, the use of such phrases should not be construed to imply that the introduction of a claim recitation by the indefinite articles “a” or “an” limits any particular claim containing such introduced claim recitation to inventions containing only one such recitation, even when the same claim includes the introductory phrases “one or more” or “at least one” and indefinite articles such as “a” or “an” (e.g., “a” and/or “an” should typically be interpreted to mean “at least one” or “one or more”); the same holds true for the use of definite articles used to introduce claim recitations. In addition, even if a specific number of an introduced claim recitation is explicitly recited, those skilled in the art will recognize that such recitation should typically be interpreted to mean at least the recited number (e.g., the bare recitation of “two recitations,” without other modifiers, typically means at least two recitations, or two or more recitations). Furthermore, in those instances where a convention analogous to “at least one of A, B, and C, etc.” is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., “a system having at least one of A, B, and C” would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). In those instances where a convention analogous to “at least one of A, B, or C, etc.” is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., “a system having at least one of A, B, or C” would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). It will be further understood by those within the art that virtually any disjunctive word and/or phrase presenting two or more alternative

terms, whether in the description, claims, or drawings, should be understood to contemplate the possibilities of including one of the terms, either of the terms, or both terms. For example, the phrase “A or B” will be understood to include the possibilities of “A” or “B” or “A and B.”

[0048] It will be further appreciated that functions or structures of a plurality of components or steps may be combined into a single component or step, or the functions or structures of one-step or component may be split among plural steps or components. The present invention contemplates all of these combinations. Unless stated otherwise, dimensions and geometries of the various structures depicted herein are not intended to be restrictive of the invention, and other dimensions or geometries are possible. In addition, while a feature of the present invention may have been described in the context of only one of the illustrated embodiments, such feature may be combined with one or more other features of other embodiments, for any given application. It will also be appreciated from the above that the fabrication of the unique structures herein and the operation thereof also constitute methods in accordance with the present invention. The present invention also encompasses intermediate and end products resulting from the practice of the methods herein. The use of “comprising” or “including” also contemplates embodiments that “consist essentially of” or “consist of” the recited feature.





**PATENT AND
TRADEMARK
ATTORNEYS**

L. S. DAVAR & CO.
KOLKATA * NEW DELHI

www.lsdavar.org.in

Head Office:
Globsyn Crystals, Tower 1, 2nd Floor,
Block EP, Plot No. 11 & 12,
Salt Lake, Sector V, Kolkata – 700091
T: +91 (33) 2357 1010 | +91 (33) 2357 1020
F: +91 (33) 2357 1018 | +91 (33) 2357 1019
E: docketing@lsdavar.in | mailinfo@lsdavar.in

Delhi Office:
F-1/2, Okhla Industrial Area, Phase-I, New
Delhi-110020, India
T: +91 (11) 26811041 | +91 (11) 26811042
F: +91 (11) 26811043 |
E: mailsdelhi@lsdavar.in | delhi@lsdavar.in
Accounts : creditcontroller@lsdavar.in

Origin: DELHI

Electronic Filing

Controller of Patents & Designs : Vijay Singh
Letter Ref. : Application No/ 202031036632

November 9, 2022

The Controller of Patents
Patent Office Branch
Intellectual Property Office Building,
CP-2, Sector – V
Salt Lake City, Kolkata-700091

Due date to respond to the Examination Report: November 10,2022

Re: Indian Patent Application No. : 202031036632
Date of Filing : 01/04/2021
Title : A ROTATIONAL THERMO-GRAFIC
IMAGING BASED BREAST CANCER
SCREENING SYSTEM
Applicant : CENTRE FOR DEVELOPMENT OF
ADVANCED COMPUTING
Date of First Examination Report : May 10, 2022

Respected Sir,

We write in response to your above referenced letter dated **May 10, 2022** with regard to the above identified Indian Patent Application. Our response to the objections raised is as follows:

PART I- Summary of the Report

Claim 1-12 were pending at the time of receiving the First Examination Report (FER). The Applicant attempts to traverse the inventive step rejections by way of arguments and amendments. Moreover, all the objections under Part III have also been attended. Detailed response to the objections raised by the Controller has been provided hereinafter.

PART II-DETAILED TECHNICAL REPORT

Objection 1:

INVENTIVE STEP

Claim(s) (1-12) lack(s) inventive step, being obvious in view of teaching (s) of cited document(s) above under reference D1-D3 for the reason stated in the first examination report.

Our Submission:

Claims 1- 12 are objected as allegedly not being inventive in view of teachings of document **D1: WO2017145127A1, D2: US4945239A** and **D3: CN208017480U** for the reason stated in the first examination report.

With regards to objection pertaining to inventive step on claims in view of cited documents, Applicants disagrees that the invention lacks inventive step, and is not allowable u/s 2(1)(j) of the Patent Act, 1970. The Applicants respectfully traverses these grounds of objections as

teaching of the referred patent documents is entirely different from present invention. Presented below are arguments in support of inventive step of the present invention.

The applicants most humbly state that the invention disclosed in our patent application *relates to rotational thermo-graphic imaging-based breast cancer screening system*. The breast cancer screening system comprises *a temperature-controlled enclosure with adjustable groove hole in order to accommodate breast*, an air conditioning unit controller, an image capturing sub-unit and a computer.

The present invention is having the following advantages:

- i) Rotational Thermographic Imaging as implemented in the present invention, offers a technique for *complete imaging of breast which leads to fewer chances of missing an abnormality for breast cancer screening patients*.
- ii) This is an *enclosed temperature-controlled Rotating Motorized system* for Infrared Imaging based Breast cancer screening with arrangements for *capturing thermographic Images with 0-180-degree viewing angles for Breast Imaging*.
- iii) The present invention describes a major role of two sets of ambient temperature for each subject, the corresponding procedure being termed as *Dynamic temperature data collection* [refer to para 0041 of Complete Specification].
- iv) The *difference in subject's response for the changes of ambient temperature is the key parameter for analyzing the affected area for this case*. This technique provides advantages for *detecting the malignancy which is related to angiogenesis* and this has been verified by the concerned doctors as well.
- v) In this system image of *breast and axilla have been taken specifically for cancer screening which requires breast part to be placed through a grooved hole and the rotating arm mounted thermal camera captures all possible images from different angles* to cater to collect

obstruction free and background noise free Infrared thermographic data for applying image processing technique to locate the actual area of interest.

- vi) The present system is *non-invasive* and *painless* in nature.
- vii) A motor controller is provided in the present system to *facilitate movement of the image capturing sub-unit.*

COMPARISON WITH D1

The cited document D1 discloses an apparatus for enabling privacy for patients undergoing breast cancer screening in a non-clinical setting. One embodiment of the present apparatus comprises an enclosure in which a person can remove one or more garments to expose their breasts to a thermal camera for breast cancer screening. The enclosure is such that at least the breast area of that person is shielded from view by third parties. The apparatus also comprises a thermal camera for capturing thermal images of the exposed breast area. The thermal camera is connected to a robotic arm that changes the camera angle relative to real-world coordinates so that thermal images can be taken of the breast area from any angle between a frontal view and a left/right lateral view. A processor which executes a software interface tool for semi-automated or automated breast cancer screening based on the thermal images of the breast.

From Fig 2 of D1 it is clear that the images captured by the system provides both breasts at a time. Also, **it exposes much more areas of the upper part of body.** This **system warrants much more difficulties in image processing technique to locate an actual area of interest.** Additionally, while taking thermal image from side view, both breasts would come to an Image Field of view. Therefore, though the nearer breast is focused, but **the other breast is defocused and thus create obstruction to capture the actual targeted breast which is undesirable.**

The applicant hereby submits that in contrast to D1, in the present invention only breast and axilla have been taken as subject thereby enabling detection in a much localized and targeted region. Herein, the breast part is placed through a grooved hole and the rotating arm mounted thermal camera is implemented to capture all the possible images from different angular directions. Consequently, there are no background noise and de-focused area unlike D1 and therefore obstruction free Infrared data is captured for further course of actions. This technique provides advantages for detecting malignancy in breast with more precision with better outcome.

The Applicant further submits that the system disclosed in D1 is a booth type system which needs critical robotic parts and booth like enclosures for privacy, consequently requiring multiple developmental aspects, preciseness and thereby contributes to higher system cost. Moreover, the system disclosed in D1 is a single ambient temperature-based system. In D1, the infrared data is collected in one ambient temperature and the infrared (IR) images collected in one instance are main input for further image processing techniques. In contrast, the present invention is a simpler robotic arm-based table top system which is also cost effective. More importantly, the present invention describes a major role of two sets of ambient temperature for each subject, this procedure is named as Dynamic temperature data collection [refer para 0041 of complete specification]. The difference in subject's response for the changes of ambient temperature is the key parameter for analyzing the affected area for this case. This technique provides advantages for detecting the malignancy which is related to angiogenesis and such features have been validated as well through concerned doctors.

Therefore, the present invention is inventive over the inventions disclosed in D1.

COMPARISON WITH D2

The cited document D2 relates to early detection of breast cancer using trans illumination. D2 discloses several methods that have been developed for improvement of trans illumination devices such that they may be effectively used for breast cancer examinations. Each of the methods involves a particular technique for reducing scattered light. If light which passes straight through a breast can be distinguished from light which is scattered within the breast, better

images can be produced. In addition, biochemical markers have been developed which associate with cancerous tissue and enhance the contrast by absorbing light of specific wavelengths. The applicant submits that the cited document D2 discloses several methods that have been developed for improvement of trans illumination devices such that they may be effectively used for breast cancer examinations whereas, the present invention discusses on the thermographic imaging-based breast cancer screening system to take thermal images at different temperatures in a thermally controlled environment and is not at all related to features of any trans illumination device.

D2 discloses about development of biochemical markers associated with cancerous tissue and such that the biochemical markers are able to enhance contrast by absorbing light of specific wavelengths. On the contrary, the present invention discloses the breast cancer screening system, comprising a temperature-controlled enclosure with adjustable groove hole, an air conditioning unit controller, an image capturing sub-unit and a computer. Herein, the system analyses captured images by executing a technique in order to detect abnormalities in breast at each angle. **D2 is completely silent of any such feature.**

The applicant further submits that the method described in the document D2 involves the breast been placed between the pressure plate in the trans illumination system which is a painful system similar to Mammography system. In contrast, the system disclosed in the present invention offers a painless method and is also non-invasive in nature. Therefore, the present invention is inventive over the inventions disclosed in D2.

COMPARISON WITH D3

The cited document D3 discloses a breast cancer detection instrument capable of adjustment of angle. The instrument includes tripod, non-slip mat, fixing pipe, telescope support, angle regulator, breast cancer device, data jack, main control chip, display screen, control panel, accumulator, start stop switch, case lid and parcel tray, the bottom of the tripod is fixedly installed non-slip mat, the top of the tripod is fixedly connected with fixing pipe, the top of the fixing pipe is telescopically connected with telescope support, the top of the telescope support is fixedly installed angle regulator,

and telescope support is connect by angle regulator with breast cancer device, the top of the angle regulator is drivingly connected breast cancer device, the rear end of the breast cancer device is electrically connected data jack. The utility model breast cancer is accurately flexible, can adjust detection angles according to demand, easy to adjust flexibly to improve detection efficiency, and senses quick, consummating function diversity

The applicant submits that **the cited document D3 system uses video camera, spotlight, focusing screw, infrared probe and detection mirror, which is a complex and completely different mechanism for breast cancer detection technique from Infrared camera based Thermo-graphic imaging used in the present invention.**

The system disclosed in D3 can capture only one angle of breast. In contrast, **the system disclosed in the present invention is capable of capturing infrared images from all the angles.**

The applicant humbly submits that in the D3,**the system resides on a tripod which rotates along its own axis and cannot ensure the minimal focus distance and accordingly cannot provide clear images at each angle and position of breast** whereas, **in the present invention the distance between the IR camera and the adjustable grooved hole in the temperature controlled enclosure depends on the minimal focus distance of the IR camera which is automatically ensured in the system and in turn ensure clear images at each and every position.**

The technical and structural difference between the cited prior arts and the present invention discussed hereinabove can be presented in tabular manner as follows:

Present Invention	D1
1. Herein, image of <i>breast and axilla have been taken as subject specifically for cancer screening which requires breast part to be placed through a grooved hole</i> thus enabling detection area to be much more localized.	1. The thermal camera rotates around the <i>patient's whole body as subject thus exposing much more area of the upper part of the body.</i>

<p>2. The rotating arm mounted thermal camera captures <i>all possible images from different angles to cater to collect obstruction free and background noise free infrared thermographic data</i> for applying image processing technique to locate the actual area of interest.</p> <p>3. The present invention describes a major role of <i>two sets of ambient temperature for each subject known as Dynamic temperature data collection</i> [refer para 0041 of complete specification]. This technique provides advantages for detecting the malignancy which is related to angiogenesis.</p> <p>4. The present invention is a <i>simpler robotic arm-based table top system</i> which is simple to implement and is also <i>cost effective</i>.</p>	<p>2. This system warrants much more difficulties in image processing techniques to locate the actual area of interest and thereby affects the screening output and <i>creates obstruction to capture the actual targeted breast which is undesirable</i>.</p> <p>3. The system disclosed in D1 is a <i>single ambient temperature-based system</i>.</p> <p>4. The system disclosed in D1 is a booth type system thereby warranting <i>multiple developmental aspects, preciseness and higher system cost</i>.</p>
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Present Invention	D2
<p>1. The present invention provides a rotational <i>thermo-graphic imaging-based breast cancer screening system</i> to take thermal images <i>at different temperatures and in a thermally controlled environment</i>.</p> <p>2. In this method there is <i>no involvement of scattered light</i> which passes straight through breast</p> <p>3. The breast cancer screening system comprises of a temperature-controlled</p>	<p>1. D2 discloses several methods that have been developed for <i>improvement of trans-illumination devices such that they may be effectively used for breast cancer examinations</i>.</p> <p>2. Each of the methods involves <i>a particular technique for reducing scattered light</i>. Herein, Light passes straight through a breast can be distinguished from light which is scattered within the breast, better images can be produced.</p> <p>3. <i>Biochemical markers have been developed which associate with</i></p>

<p>enclosure with adjustable groove hole, an air conditioning unit controller, an image capturing sub-unit and a computer for detection of abnormalities based on <i>IR image segmentation depending upon thermal region of interest at each angle of the breast under test.</i></p> <ul style="list-style-type: none"> 4. The system offers a <i>painless technique.</i> 5. Infrared Imaging based system detects Breast cancer with higher sensitivity and accuracy which can be utilized for screening adequately. 	<p><i>cancerous tissue</i> and enhance the contrast by absorbing light of specific wavelengths.</p> <ul style="list-style-type: none"> 4. Herein, the breast is placed between the pressure plate in the trans-illumination system which is a <i>painful system</i> similar to Mammography system. 5. Although transillumination light scanning can detect some small curable breast cancers, it does not do so at a sensitivity adequate for screening.
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Present Invention	D3
<ul style="list-style-type: none"> 1. The present invention provides a rotational <i>thermo-graphic imaging-based breast cancer screening system</i> to take thermal images <i>at different temperatures and in a thermally controlled environment.</i> 2. The advantage of the present system is that <i>it can capture infrared images from all the angles.</i> 3. The distance between the IR camera and the adjustable grooved hole in the temperature-controlled enclosure [101] <i>depends on the minimal focus distance of the infra-red (IR) camera</i> which is automatically ensured in the present system thereby ensuring clear images at each and every position. 	<ul style="list-style-type: none"> 1. The cited document D3 discloses a breast cancer detection instrument capable of adjustment of angle. 2. The system disclosed in D3 can capture <i>only one angle of breast.</i> 3. The system resides on a tripod which rotates along its own axis and <i>cannot ensure the minimal focus distance and accordingly cannot provide clear images at each angle and position of breast.</i>

- Accordingly, the Applicant humbly submits that the solution provided by the invention in the present application is different from the disclosure or teachings of D1-D3. Also, those skilled in the art would not be motivated to refer to teachings or disclosures of D1-D3, when faced with an objective of the present invention, to achieve the claimed invention involving “*a temperature controlled enclosure (101) having an adjustable grooved hole (102) in the front wall (105) to accommodate one breast*” and “*the image capturing sub-unit (103) comprising an infra-red camera (106) provided at an end of a rotating arm (107) to facilitate capturing of the thermo-graphic image of breast from different angles and from both axilla*” as mentioned in claim 1 of the present invention. Further, to this fundamental lack of motivation, even if a person having ordinary skill in the art was specifically asked to combine D1-D3, i.e., using impermissible hindsight, he/she would not have arrived at the claimed invention as the above emphasized features of amended claim 1 of the present invention are not disclosed in any of the prior art documents and the result of the combination D1-D3 would not reach the invention as claimed in present amended independent claim 1 and the associated dependent claims.

From the aforesaid discussion, it is clear that the inventive concept of the alleged invention is not clashing with that of the cited arts individually and in any combination thereof. Thus, it is inventive over the cited prior arts. Hence, it does qualify definition of Section 2(1) (j) with wider industrial application. Further, adopting ideas from the cited documents, one can't deduce the inventive features of the subject invention. Therefore, it is not obvious to a person skilled in the art U/S 2(1) (ja) of the Patents (Amendment) Act, 2005.

The Applicant, therefore, requests to withdraw the present objection related to inventive step from pending claims 1-12.

Objection 2:

NON PATENTABILITY

Claim(s) (1-12) are statutorily non-patentable under the provision of clause (3(k)) of Section 3 for the following reasons: Without prejudice to section 2(1)(j), the subject matter of claims 1-12 refers to a computer to operate the movement of the image capturing sub-unit and capturing the thermo-graphic images from different angles. Without sufficient disclosure, it appears that the claims are

directed to “computer programme products” or “Storage Medium having instructions” or “Database” or “Computer Memory with instruction” stored in a computer readable medium which are nothing but “computer programme per se” (Refer CRI Guidelines para 4.5.4). Hence, the subject matter of the said claims 1-12 is not patentable u/s 3(k) of The Patents Act, 1970 (as amended)

Our Submission:

At the outset, the Applicant submits that as per the latest CRI guidelines published by the IPO on June 30, 2017. Section 4.5 of the new CRI guidelines provide the following:

“What is important is to judge the substance of claims taking whole of the claim together. If any claim in any form such as method/process, apparatus/system/device, computer program product/computer readable medium falls under the said excluded categories, such a claim would not be patentable. However, if in substance, the claim, taken as whole, does not fall in any of the excluded categories, the patent should not be denied”

Hence, as per the latest CRI guidelines, an invention cannot be considered to be non-patentable by only considering novel hardware features. Rather, the invention as whole has to be considered.

The Applicant further submits that Section 3(k) prescribes only “computer program per se” from patentability and not the genuine invention which has been emerged with the contribution of computer program. There exists a clear difference between the term ‘computer program’ and ‘computer program per se’ and therefore the program which adds significant contribution in enhancing a particular technology should not be unnecessarily stretched to cover every aspect of program under the exclusion.

Section 3 of the patents Act, 1970: What are not invention:

(k) a mathematical or business method or a computer programme per se or algorithms;

The addition of the terms ‘per se’ in Section 3(k) was a conscious step and the Report of the Joint Committee on the Patents (Second Amendment) Bill, 1991 specifically records the reasons for the addition of this term in the final statute as under:

“In the new proposed clause (k) the words "per se" have been inserted. This change has been proposed because sometime the computer programme may include certain other things, ancillary thereto or developed thereon. The intention here is not to reject them for grant of patent if they are inventions. However, the computer programmes ‘as such’ are not intended to be granted patent. The Page no. 2, Report of the Joint Committee on the Patents (Second Amendment) Bill, 1999 (19th December, 2001) amendment has been proposed to clarify the purpose.”

In fact, Hon’ble Delhi High Court in **Ferid Allani vs Union of India & Ors W.P.(C) 7/2014 & CM APPL. 40736/2019** has acknowledged the legislative intent of addition of term ‘per se’ and went on to say that in today’s digital world, when most inventions are based on computer programs, it would be retrograde to argue that all such inventions would not be patentable.

Para 10.

“In today’s digital world, when most inventions are based on computer programs, it would be retrograde to argue that all such inventions would not be patentable. Innovation in the field of artificial intelligence, block chain technologies and other digital products would be based on computer programs, however the same would not become non-patentable inventions - simply for that reason. It is rare to see a product which is not based on a computer program. Whether they are cars and other automobiles, microwave ovens, washing machines, refrigerators, they all have some sort of computer programs in-built in them. Thus, the effect that such programs produce including in digital and electronic products is crucial in determining the test of patentability”

The Applicant submits that the subject matter does not relate to a computer program per se just because the claimed system is implemented on a processor. The Applicant further submits that the presence of technical contribution and technical effect is the correct basis for determining whether the claimed invention falls within the scope of Section 3(k) of the Act. The claimed subject matter exhibits a technical contribution and has a technical effect.

It is further submitted that the principles involving technical effect or technical contribution for assessing patentability under Section 3(k) of the Act, have been recently discussed in the Delhi High Court's decision in the case of **TELEFONAKTIEBOLAGET LM ERICSSON v. INTEX TECHNOLOGIES (INDIA) LIMITED [CS(OS) No.1045/ 2014]**. The High Court in the present case, while discussing on the issue of patentability of subject matter under Section 3(k) stated the following at paragraph 120:

"Thus, it appears to me prima facie that any invention which has a technical contribution or has a technical effect and is not merely a computer program per se as alleged by the defendant and the same is patentable. The objection raised by the defendant in the suit for infringement is not tenable, however, admittedly defendant's revocation petitions are pending, the same have to be considered on merit including the objection of Section 3(k) and (m). At this interim stage, this court is not impress with the argument of the defendant that the injunction be refused on this ground."

The Applicant however submits that the term "technical effect" is not defined in the Patents Act. The term "technical effect" and "technical advancement" are defined in draft CRI guidelines 2013 but could not be found in latter guidelines issued in 2016 and 2017. The meaning of technical effect is defined as a solution to a technical problem, which the invention taken as a whole, tends to overcome whereas the meaning of technical advance is solution to a technical problem, which the invention taken as a whole, tends to overcome. The Applicant further submits that the provisions of the Act are in *pair material* with the provisions of UK Patents Act, 1977 and the European Patent Convention (EPC). Thus, the Applicant relies on decisions of such jurisdictions to determine as to how presence of technical effect can be ascertained.

The Applicant relies on the case of **HTC Europe Co. Ltd v. Apple Inc. [2013] EWCA Civ 451**, decided by the UK Court of Appeals for the definition of technical effect. The present decision has also been relied on by the Delhi High Court in their decision of Ericsson case. The Court of Appeals in their opinion on the patentability of such subject matter held at paragraph 46 that:

“Second, the fact that improvements are made to the software programmed into the computer rather than hardware forming part of the computer does not make a difference. As I have said, the analysis must be carried out as a matter of substance not form.”

The Court of Appeal in their opinion also held at paragraph 49 that an invention which solves a technical problem within the computer, will have a relevant technical effect in that it will make the computer, an improved device. With the reasoning as provided in their opinion in paragraphs 47-52, the Court further analysed the subject matter and concluded that the lower Courts had in fact, in error, held such subject matter to be non-patentable. More specifically, the Court of Appeals while revisiting the analysis of the lower Courts held in paragraphs 54-57 that just because the software was used for implementing the invention, it cannot be rejected solely on such grounds. The Court of Appeal, while reformulating the technical problem which the invention addressed, specifically held that as a result of the software, the computing device itself operated in a new and improved manner. That alone is sufficient to establish that the subject matter is patentable.

The Applicant respectfully submits that the invention claimed in amended claims 1 and 2 relates to rotational thermo-graphic imaging based breast cancer screening system

In particular, the present invention intends to detect breast cancer by a non-invasive manner using a rotational thermo-graphic imaging-based breast cancer screening system. The breast cancer screening system comprises a temperature-controlled enclosure with adjustable groove hole, an air conditioning unit controller, an image capturing sub-unit and a computer. The computer is a hardware device and comprises of a number of processing devices including an image capturing subunit for performing the functionalities and processing the image captured. Therefore, the invention is having a significant technical effect and is highlighting a solution to a technical problem existing in the prior arts. Therefore, the Applicant respectfully submits that the present invention should not be regarded as something falling within the ambit of computer program per se or algorithm.

In the light of facts stated above and required amendment in the claims, as already mentioned, present invention has satisfied the criteria of patentability over the prior art documents and is having

technical as well as economic advancement over the existing technologies. Hence it is clear that amended claim does not fall under section 3 (k) of Indian patent act 1970 under any circumstances. So we humbly request Learned Controller to kindly consider all the above submissions, contentions and the legislative intention to attached suffix per se to computer program and withdraw this objection.

Objection 3

SUFFICIENCY OF DISCLOSURE:

- I) The complete specification does not fully and particularly describe the invention and its operation and the method by which it is to be performed in respect of:
The Complete Specification shall clearly mention the technical problems associated with the existing technology and the solution for that, bringing out the differences between the claimed invention and the prior art. The solution sought by the invention should be clearly brought out as object(s) of inventions.
- II) Abstract specified u/s 10(4)(d) of the Patents Act,1970(as amended) shall be prepared u/r 13(7)(b) of the Patents Rules, 2003 (as amended).

OUR SUBMISSION:

1. The Applicant submits that the complete specifications is chosen to complies with the requirement of Section 10(4) and clearly define particularly describe the invention and its operation or use and the method by which it is to be performed. Herein, the problem statement has been well identified discussing the available prior arts and their disadvantages (*refer para [003] to [007]*). Further, accordingly objects of the present invention has been delineated (*refer para [008] to [0014]*). Further, the invention has been discussed in detail (*refer para [0034] to [0048]*) with reference to the diagrams. Therefore, the Applicant requests the Learned Controller to take the complete specification of the present invention on record and kindly waive the objection.

2. The Applicant submits the present wording of the amended abstract is in accordance with u/s 10(4)(d) of the Patents Act,1970(as amended) and Rule 13(7)(b) of the Patents Rules, 2003 and clearly defines the technical field to which the invention belongs, technical problem to which the invention relates and the solution to the problem through the invention and principal use or uses of the invention. Therefore, the Applicant requests the Learned Controller to take the abstract of the present invention on record and kindly waive the objection.

Objection 4:

CLARITY AND CONCISENESS:

1. Claim 1 shall be redrafted properly such that the nature & scope of the alleged invention can be clearly ascertained. The statement of claim should, therefore, be revised & all essential features of the device should be brought in said claim while subsidiary features of the claim may be claimed in the dependent claims.
2. To meet the requirements of u/s 10 (4) of The Patents Act,1970(as amended) in combination with rule 13 of the Patents Rules, 2003 (as amended), any independent claim shall be correctly cast in the two-part form, with those features which in combination are part of the prior art being placed in the preamble. The characterising portion of any new independent claim should be preceded by the expression "characterised in that" or "characterised by".

Our Submission:

1. The Applicant submits that claims of the present invention comprises of features related to novelty and inventive step in an independent claim followed by additional features in the dependent claims. The corresponding features of the present invention have been already discussed while responding to Objection 1. Therefore, the Applicant finds that it is not necessary

to re-draft the claims of the present invention as it is already catering to the above mentioned requirement. In view of this, the Applicant requests the Learned Controller to kindly waive off the objection.

2. The Applicant submits that the claims of the present invention are such that it possesses novel and inventive features as argued under the objection of Inventive Step, and delineating or casting the claim into two-part will not justify the protection which the Applicant hereby seeks. Therefore, the Applicant has not characterized the independent claim 1 of the present invention as characterizing the same would not justify the minimum requirements for the present invention to be novel and inventive.

Objection 5:

OTHERS REQUIREMENTS:

In case the applicant contemplates amending the claims subsequent to this report, the same shall be drafted afresh to include the technical advancement over the prior art cited, in the Independent claim/s as required u/s 2(1) (j) of the Patent's Act,1970(as amended). Please be informed that no new matter shall be added such that the scope of original disclosure changes. That is care shall be taken that requirement of section 59 (1) of the Act is also met while any amendment is done. Please indicate in the response communication the support for such amendments of claims in the original specification, as required u/s 10(4) of the Act. Please provide an additional copy of marked-up amendments (highlighting the amendments) where ever applicable u/r 14 of The Patents Rule,2003(as amended). In the case of disagreement with this report, the same shall be supported by technical reasons thereof.

Our Submission:

1. The Applicant has complied with the objections raised.

PART-III: FORMAL REQUIREMENTS

Date and Signature of Applicant

All forms shall be duly signed by the applicant or authorized person/patent agent (along with the name of the signatories) in the appropriate space provided on the form u/r 8 of The Patents Rules, 2003(as amended).

Our Submission:

The Applicant has complied with the objections raised.

Statement & Under Taking (Form 3 Details)

Updated Annexure of Form 3 with prescribed format shall be filed u/s 8(1)(b) of the Indian Patents Act,1970(as amended) and within the prescribed period u/r 12(2) of The Patents Rules, 2003 (as amended).

Our Submission:

The Applicant has not filed any corresponding foreign applications in any country outside India. The Applicant herein submits an updated Form- 3 along with the present response. Therefore, the Learned Controller is requested to take the updated Form-3 on record and kindly waive the objection.

Power of Attorney (Whether GPA, SPA, Stamped, requisite fee etc.)

Fresh Power of Authority shall be filed in accordance with the rule 135 of The Patents Rules, 2003, with the legible and prescribed stamp duty as under the Indian Stamp Act,1899.

Our Submission:

The Applicant has complied with the objections raised.

Format of Specification (rule 13)

Irrelevant information provided in the margins of the title, description, claims, drawings and abstract shall be deleted and blank spaces shall be scored out in accordance with the rule 13(5) of The Patents Rules,2003(as amended).

Fresh Pages of complete specification after incorporating necessary amendments shall be retyped and submitted to form a continuous document u/r 14(1) of The Patents Rules,2003(as amended).

Our Submission:

The Applicant has complied with the objections raised.

Format of Drawings

No descriptive matter shall appear on the drawings except in the flow diagrams as per rule 15(7) of The Patents Rules, 2003(as amended).

Our Submission:

The Applicant submits that the reformatted drawings submitted u/s 10(2) of The Patents Act, 1970(as amended) sufficiently provide explanation to the Invention as required u/r 13(4) of the Patents Rule, 2003(as amended). The Applicant therefore requests the Learned Controller to take the reformatted drawings on record and kindly waive off the objection.

Other Deficiencies

1. Fresh Form 1, Form 3, Form 5 shall be filed with application number and signature of the authorised signatories after incorporating necessary amendments.

2. Any request for correction of an error in Complete Specification shall be submitted in a prescribed manner u/s 78(2) of The Patents Act,1970 (as amended) and u/r 122 of The Patents Rule,2003(as amended)

Our Submission:

1. The Applicant respectfully submits the fresh Form 1, Form 3, Form 5 duly filed with application number and signature of the authorised signatories.
2. The Applicant has complied with the objections raised.

PRAYER

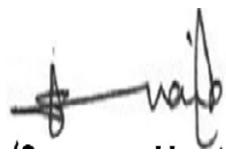
In view of the above, the Applicant requests the Learned Controller to consider the aforementioned arguments and withdraw objections on formal requirements of the instant patent application.

In view of the aforementioned response, the Applicant believes that all the objections raised in the FER are suitably addressed. Therefore, the Applicant respectfully requests the Patent Office to Grant a Patent for the instant invention. The Applicant requests the Learned Controller to provide an opportunity to respond to further objections if any. However, if the Learned Controller is still not satisfied with the response, then the Applicant respectfully seeks an opportunity for hearing, preferably a telephonic interview to expedite the Grant of Patent.

However, if the proposed telephonic discussion does not result in a resolution, then a request is hereby made for a hearing *via* video conferencing under section 14 of the Indian Patents Act, 1970, as per the convenience of the Learned Controller.

We thank you in advance for your cooperation in this regard.

Yours sincerely,



SOURABH VAID
PATENT AGENT
IN/PA – 1814
OF L. S. DAVAR & CO.,
APPLICANT'S AGENT
TNC/tkb

Enclosures:

1. Marked-up and Clean copy of claims;
2. Fresh Form-1, Form-5;
3. Reformatted Complete Specification with Form-2;
4. Updated Form-3 with NIL status;
5. Re-formatted drawings;
6. A copy of GPA alongwith additional Stamp Duty.

FORM – 3

THE PATENTS ACT, 1970 (39 of 1970)

STATEMENT AND UNDERTAKING UNDER SECTION 8 [See Rule 12]

We, **CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING** having address at **PLOT - E-2/1, BLOCK-GP, SECTOR-V SALT LAKE ELECTRONICS COMPLEX BIDHAN NAGAR, KOLKATA, WEST BENGAL, 700091, INDIA** an Indian Company.

hereby declare:

- i. That I/ we have not made any application for the same / substantially the same invention outside India.
- ii. that we who have made this Application No.: _____ dated **24/08/2020** titled "**A ROTATIONAL THERMO-GRAPHIC IMAGING BASED BREAST CANCER SCREENING SYSTEM**" ~~made for the same/substantially same invention application(s) for patent in the other countries, the particulars of which are given below:~~

Name of the country	Date of application	Application no.	Status of the application.	Date of publication	Date of grant.
Nil	Nil	Nil	Nil	Nil	Nil

- iii. that the rights in the application(s) has/have been assigned to none.

that we undertake that up to the date of grant of the patent by the controller, I/We would keep the Controller informed in writing the details regarding corresponding applications for patents filed outside India within three months from the date of filing of such application.

Dated this 24th day of August, 2020

**SAURABH VAID
IN/PA-1814
L.S. DAVAR & CO.,
APPLICANT'S AGENT**

To,
The Controller of Patents,
The Patent Office Branch,
Kolkata