

CLAIMS:

1. A retinal imaging system comprising:
 - a fundus camera having a focusing mechanism;
 - an imaging module configured for imaging user's face and eyes and providing
 - 5 image data indicative of a relative orientation between an optical axis of the fundus camera and a line of sight of user's eye at user's eye target position;
 - a position and alignment system configured and operable to utilize the image data indicative of said relative orientation for positioning the fundus camera at an operative position such that the optical axis substantially coincides with the line of sight
 - 10 of user's eye, to enable focusing the fundus camera on the retina;
 - a sensing system comprising one or more sensors, configured and operable for monitoring a user's face position with respect to a predetermined registration position and generating corresponding sensing data; and
 - a safety controller configured and operable to be responsive to the sensing data,
 - 15 and upon identifying that the user's face position with respect to the predetermined registration position corresponds to a predetermined risk condition, generating a control signal to the position and alignment system to halt movements of the fundus camera.
2. The system of claim 1, comprising a control system which comprises:
 - a position controller configured and operable to be responsive to the image data
 - 20 and the sensing data to generate position and alignment data to said position and alignment system to perform controllable movements of the fundus camera to bring the fundus camera to the operative position; and
 - a movement controller configured and operable to be responsive to the sensing data and to the control signal from the safety controller to operate the position and
 - 25 alignment system to halt the movements of the fundus camera.
3. The system of claim 1 or 2, wherein the safety controller is configured and operable to analyze the sensing data from one or more sensors of the sensing system indicative of a distance between the user's face and the fundus camera to enable generation of said control signal upon identifying a change in said distance corresponding
- 30 to the risk condition.

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4. The system of claim 3, said one or more sensors providing the distance data comprises at least one ultrasound sensor.
5. The system of any one of the preceding claims, wherein said position and alignment system comprises:
- 5 a first driving mechanism operable in accordance with the alignment data for moving the fundus camera to a vertical aligned position of the optical axis corresponding to a vertical alignment with user's pupil;
- a second driving mechanism operable in accordance with the alignment data for moving the fundus camera to a lateral aligned position of the optical axis corresponding to substantial coincidence of the optical axis with the line of sight; and
- 10 a third driving mechanism operable in accordance with the sensing data and a focal data of the fundus camera for moving the fundus camera along the optical axis to position a focal plane of the focusing mechanism at the retina of the user's eye.
6. The system of claim 5, wherein the position and alignment system further
- 15 comprises a rotation mechanism for rotating the fundus camera with respect to at least one axis.
7. The system of any one of the preceding claims, comprising a registration assembly for registering a position of user's face, said registration assembly comprising a face cradle for fixation of user's face at the registered position during imaging.
- 20 8. The system of claim 7, wherein said sensing system comprises one or more sensors on said face cradle for monitoring a degree of contact of the user's face to the face cradle.
9. The system of claim 8, wherein said one or more sensors on said face cradle include at least one of the following: at least one pressure sensor, or at least one IR sensor.
- 25 10. The system of claim 9, wherein said one or more sensors on said face cradle include at least one pressure sensor comprises at least three sensing elements located in three spaced-apart locations to monitor degree of contact in respective at least three contact points with the face cradle.

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11. The system of any one of the preceding claims, wherein said target position corresponds to a predetermined orientation of the user eye's line of sight with respect to at least one predetermined fixation target exposed to the user.
12. The system of claim 11, wherein said target position corresponds to intersection
5 of the user eye's line of sight with the predetermined target presented by the fundus camera.
13. The system according to any one of the preceding claims, further comprising a calibration mechanism configured and operable to perform self-calibration of the system, said calibration mechanism comprising at least one imager, one or more calibration
10 targets located in a field of view of said at least one imager, and a calibration controller configured and operable to receive and analyze image data from said at least one imager and determine a relative position of an optical head of the fundus camera with respect a region of interest.
14. The system according to claim 13, wherein said at least one calibration target
15 includes at least one of the following: a two-dimensional element, color pattern, and QR codes.
15. The system of any one of the preceding claims, wherein the imaging module comprises at least one imager.
16. The system of claim 15, wherein said at least one imager is configured as a 3D
20 imager.
17. The system of claim 15 or 16, wherein the imaging module comprises two imagers with intersecting fields of view.
18. The system of any of the preceding claims, comprising a user interface utility configured and operable to provide position and fixation target instructions to the user.
- 25 19. The system of claim 18, wherein said position and fixation target instructions correspond to registration of, respectively, the user's face position and orientation of the eye's line of sight.
20. The system of claim 18 or 19, wherein said position and fixation target instructions comprise at least one of audio and visual instructions.

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21. The system according to any one of claims 7 to 20, wherein the imaging module is further configured and operable to provide image data indicative of one or more parameters of the user, the system further comprising a face cradle position controller configured and operable to the image data indicative of one or more parameters of the user and generate operational data to a movement mechanism of the face cradle to automatically adjust position of the face cradle with respect to the fundus camera based on said one or more parameters of the user.

22. The system according to any of claims 7 to 21, wherein the registration assembly is configured and operable for registering the position of user's face with respect to the fundus camera, the registration assembly comprising a support platform carrying the face cradle defining a face support surface for supporting the user's face at the registered position during imaging, the face support surface being tilted with respect to a vertical plane such that user's eyes look general forward and downwards towards the fundus camera.

23. The system of claim 22, wherein the fundus camera and the face cradle are mounted on the support platform.

24. The system of claim 22 or 23, wherein the face cradle comprises a face contact frame projecting from said face support surface.

25. The system of claim 24, wherein the face contact frame is made from elastic and flexible material composition.

26. The system of claim 24 or 25, wherein the face contact frame is removably attachable to the face cradle, allowing the face contact frame to be disposable or replaceable.

27. The system of any of the preceding claims, further comprising an illumination system configured and operable to provide illumination within a region of interest where the user's face is positioned during imaging by the fundus camera.

28. The system of claim 27, wherein said illumination system is configured and operable to produce diffused (soft) light.

29. The system of claim 27, wherein said illumination system is configured and operable to produce IR illumination.

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30. The system according to any one of the preceding claims, comprises a triggering utility configured and operable to be responsive to the position and alignment data and the distance data to generate a triggering signal to the fundus camera upon identifying that the position and alignment data and the distance data satisfy an operational condition.
- 5 31. The system according to any one of the preceding claims, wherein said imaging module is configured and operable to image the user's eye using IR illumination to detect the eye pupil.
32. The system according to any one of the preceding claims, comprising a data processor configured and operable to be responsive to retina image data from the fundus camera, and generate data indicative of a retinal condition and patient health condition.
- 10 33. The system according to claim 32, wherein said data processor is configured and operable to apply AI and deep learning processing to the retina image data.
34. The system according to claim 32 or 33, configured and operable to communicate with a remote station to transmit to the remote station data indicative of the retina image data.
- 15 35. A retinal imaging system comprising a face cradle and a fundus camera, wherein: the fundus camera is configured such that its optical axis is tilted with respect to a horizontal plane; and the face cradle defines a tilted face support surface for supporting a user's face in a free laying state with user's eyes looking forward and downwards towards a field of view of the fundus camera.
- 20 36. The support platform of claim 35, wherein the face cradle comprises a face contact frame projecting from said face support surface.
37. The support platform of claim 36, wherein the face contact frame is made from elastic and flexible material composition.
- 25 38. The support platform of claim 35 or 36, wherein the face contact frame is removably attachable to the face cradle, allowing the face contact frame to be disposable or replaceable.