

WHAT IS CLAIMED IS:

1. A guided robotic system, comprising:
a magnetic imaging apparatus for continuously acquiring magnetic resonance images of a subject;
a robotic arm, and
a computer system for analyzing the magnetic resonance images and identifying a portion of the subject,
wherein the magnetic resonance images are analyzed in real-time for guiding the robotic arm to the portion of the subject.
2. The system of claim 1, wherein the robotic arm is attached to a component configured for drug delivery.
3. The system of claim 1, wherein the robotic arm is configured for inserting a needle into the portion of the subject for extracting a specimen.
4. The system of claim 1, wherein the robotic arm is configured for placing a stent into the portion of the subject.
5. The system of claim 1, wherein the robotic arm is attached to a needle configured for removing a sample from the portion of the subject.
6. The system of claim 1, wherein the robotic arm is configured for removing the identified portion by cutting the portion of the subject.
7. The system of claim 1, wherein the robotic arm is attached to an end-effector containing a plurality of needles.
8. The system of claim 1, wherein the robotic arm is attached to an end-effector configured for carrying one or more stents.
9. The system of claim 1, wherein the robotic arm is attached to an end-effector configured for carrying one or more brachytherapy seeds.

10. The system of claim 1, wherein the robotic arm is configured for extracting a specimen for examination in a medical procedure from the list of medical procedures consisting of transperineal biopsy, transperineal LDR brachytherapy, transperineal HDR brachytherapy, transperineal laser ablation, transperineal cryoablation, transrectal HIFU, breast biopsies, deep brain stimulation (DBS), brain biopsy, liver biopsy, kidney biopsy, lung biopsy, coronary stent insertion, brain stent insertion, and intensity modulated radiation treatment guidance.
11. A method of using a guided robotic system, the method comprising:
acquiring live magnetic resonance images of a subject;
performing image analysis of the live magnetic resonance images to continuously identify a target portion of the subject;
automatically guiding a robotic arm towards an identified target portion of the subject based on the live magnetic resonance images; and
performing a procedure at the target portion of the subject.
12. The method of claim 11, wherein acquired live magnetic resonance images are displayed within a graphical user interface (GUI) that includes functional buttons for controlling the procedure.
13. The method of claim 11, wherein acquired live magnetic resonance images comprise a high resolution image portion near a needle inserted during the procedure and a lower resolution image portion farther away from the needle.
14. The method of claim 11, further comprising:
correcting acquired live magnetic resonance images for patient motion during the performing of the procedure.
15. The method of claim 11, further comprising:
correcting acquired live magnetic resonance images for motion artifacts during insertion of the needle.
16. The method of claim 14, further comprising:
overriding existing action to manually correct for the patient motion.
17. The method of claim 11, further comprising:

manually advancing the robotic arm by controlling the GUI using a touch input, a mouse input or a joystick input.

18. The method of claim 11, further comprising:

- providing a needle attached to the robotic arm,
- performing automatic segmentation to capture location of the needle;
- withdrawing the needle; and
- advancing the needle to a next target location.

19. The method of claim 11, wherein the procedure includes one from the list of medical procedures consisting of transperineal biopsy, transperineal LDR brachytherapy, transperineal HDR brachytherapy, transperineal laser ablation, transperineal cryoablation, transrectal HIFU, breast biopsies, deep brain stimulation (DBS), brain biopsy, liver biopsy, kidney biopsy, lung biopsy, coronary stent insertion, brain stent insertion, and intensity modulated radiation treatment guidance.

20. A method of using a guided robotic system, the method comprising:

- continuously acquiring magnetic resonance images of a subject;
- continuously identifying a target portion of the subject in the magnetic resonance images;
- guiding a needle attached to a robotic arm towards an identified target portion of the subject, wherein the magnetic resonance images are analyzed in real-time for guiding the needle to the target portion of the subject; and
- inserting the needle to the target portion of the subject and extracting a specimen.

21. The method of claim 20, wherein continuously acquired live magnetic resonance images are displayed within a graphical user interface (GUI) that includes functional buttons for controlling during insertion of the needle.

22. The method of claim 20, wherein continuously acquired live magnetic resonance images comprise a high resolution image portion near the needle and a lower resolution image portion farther away from the needle.

23. The method of claim 20, further comprising:

- automatically correcting the continuously acquired live magnetic resonance images to compensate for motion blurring during insertion of the needle.

24. The method of claim 23, further comprising:
automatically correcting a trajectory of the needle during the insertion based on corrected acquired live magnetic resonance images.
25. The method of claim 23, further comprising:
overriding existing guided trajectory to manually correct for the motion blur.
26. The method of claim 20, further comprising:
manually advancing the robotic arm by controlling the GUI using a touch input, a mouse input or a joystick input.
27. The method of claim 20, further comprising:
performing automatic segmentation to capture location of the needle;
withdrawing the needle; and
advancing the needle to a next target location.
28. The method of claim 20, wherein extracted specimen is examined in a medical procedure from the list consisting of transperineal biopsy, transperineal LDR brachytherapy, transperineal HDR brachytherapy, transperineal laser ablation, transperineal cryoablation, transrectal HIFU, breast biopsies, deep brain stimulation (DBS), brain biopsy, liver biopsy, kidney biopsy, lung biopsy, coronary stent insertion, brain stent insertion, and intensity modulated radiation treatment guidance.
29. The method of claim 20, wherein the guiding further includes guiding the needle through a bore at the center of a magnetic imaging apparatus configured for continuously acquiring magnetic resonance images.
30. A method of using a guided system, the method comprising:
acquiring live magnetic resonance images of a subject;
continuously identifying a target portion of the subject in the live magnetic resonance images;
guiding an end-effector attached to a mechanical arm towards an identified target portion of the subject, the end-effector carrying a plurality of needles; and
inserting the plurality of needles one at a time at the target portion of the subject and extracting a plurality of specimens from the target portion of the subject.

31. The method of claim 30, wherein acquired live magnetic resonance images are displayed within a graphical user interface (GUI) that includes functional buttons for controlling during insertion of the plurality of needles.
32. The method of claim 30, wherein acquired live magnetic resonance images comprise a high resolution image portion near an inserted needle and a lower resolution image portion farther away from the inserted needle.
33. The method of claim 30, further comprising:
automatically correcting the acquired live magnetic resonance images to compensate for motion blurring during insertion of the plurality of needles.
34. The method of claim 33, further comprising:
automatically correcting a trajectory of an inserted needle during the insertion based on corrected acquired live magnetic resonance images.
35. The method of claim 34, further comprising:
overriding existing guided trajectory to manually correct for the motion blur.
36. The method of claim 30, further comprising:
manually advancing the mechanical arm by controlling the GUI using a touch input, a mouse input or a joystick input.
37. The method of claim 30, further comprising:
performing automatic segmentation to capture location of an inserted needle;
withdrawing the inserted needle; and
inserting a further needle at a next location.
38. The method of claim 30, wherein extracted specimens are examined in one or more medical procedures from the list consisting of transperineal biopsy, transperineal LDR brachytherapy, transperineal HDR brachytherapy, transperineal laser ablation, transperineal cryoablation, transrectal HIFU, breast biopsies, deep brain stimulation (DBS), brain biopsy, liver biopsy, kidney biopsy, lung biopsy, coronary stent insertion, brain stent insertion, and intensity modulated radiation treatment guidance.
39. The method of claim 30, wherein the guiding of the end-effector attached to the mechanical arm towards the identified target portion of the subject includes guiding through

a bore at the center of a single-sided magnetic imaging apparatus configured for continuously acquiring magnetic resonance images.

40. A guided robotic system, comprising:
an imaging apparatus for real-time imaging of a subject;
a computer system for analyzing images in real-time; and
a robotic system comprising a robotic arm, wherein the robotic system is configured to guide the robotic arm during a surgical procedure based on real-time analysis of the images, and wherein the robotic arm comprises:

a proximal end; and

a distal end configured to hold a robotic surgical tool;

wherein the imaging apparatus is positioned intermediate the proximal end of the robotic arm and the subject during the surgical procedure.

41. The system of claim 40, wherein the distal end of the robotic arm is attached to a component configured for drug delivery.

42. The system of claim 40, wherein the distal end of the robotic arm is configured for inserting a needle into the subject for extracting a specimen.

43. The system of claim 40, wherein the robotic arm is configured for placing a stent into the subject.

44. The system of claim 40, wherein the robotic arm is attached to a needle configured for removing a sample from the subject.

45. The system of claim 40, wherein the robotic arm is attached to an ablation tool.

46. The system of claim 40, wherein the distal end of the robotic arm is attached to an end-effector containing a plurality of needles.

47. The system of claim 40, wherein the distal end of the robotic arm is attached to an end-effector configured for carrying one or more stents.

48. The system of claim 40, wherein the distal end of the robotic arm is attached to an end-effector configured for carrying one or more brachytherapy seeds.

49. The system of claim 40, wherein the robotic arm is configured for extracting a specimen for examination in a medical procedure from the list of medical procedures consisting of transperineal biopsy, transperineal LDR brachytherapy, transperineal HDR brachytherapy, transperineal laser ablation, transperineal cryoablation, transrectal HIFU, breast biopsies, deep brain stimulation (DBS), brain biopsy, liver biopsy, kidney biopsy, lung biopsy, coronary stent insertion, brain stent insertion, and intensity modulated radiation treatment guidance.
50. The system of Claim 40, wherein the robotic arm is configured to extend through a bore in the imaging apparatus to position the distal end of the robotic arm proximate to the subject.
51. The system of Claim 40, wherein the robotic arm comprises a motor, and wherein the imaging apparatus comprises an active noise cancellation module configured to:
- detect noise generated by the motor; and
 - remove detected noise from the acquired signals.
52. The system of claim 40, wherein the imaging apparatus is a single-sided magnetic resonance imaging apparatus having a bore at its center.