MRI Documentation

Initial Draft

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Contents

1. Overview

In this document I will outline the elements and components of an MRI in addition to showing its processes through diagrams. Before that I will also give a brief overview of the system in general and explain its workings.

2. Elements and Requirements

Image Processing

Image Processing is one of the most elementary parts of the whole MRI-System, since without it a medical analysis is impossible. To do this effectively a number of components is required to make this possible. These are in no particular order:

- 12-Bit, 1.5Gsps High-Dynamic Performance DAC [6]
- High-Dynamic-Range, 16-Bit, 100Msps ADC with -82dBFS Noise Floor [7]
- Ultra-Low-Power, 8-Channel, 12-Bit, 64Msps ADC [8]
- Ultra-Low-Power, Octal, 12-Bit, 50Msps, 1.8V ADC with Serial LVDS Outputs [9]
- Ultra-Low-Power, 8-Channel, 12-Bit, 40Msps ADC [10]

3. Models

3.1 Activity Diagram Patient

Initially the patient lays down on the bed of the MRI and gets comfortable to begin the procedure. They can adjust themselves and have to keep their arms on their body. After that the bed begins to move and is brought into position for the scanning procedure to begin. A scan is then started and completed and a decision has to be made to either continue scanning or if the scanning is complete. Should more scans be necessary the bed moves to a new position and the scanning continues. If it is then decided that the scanning has finished the bed is moved back to its initial position and the patient is able to stand up and leave.
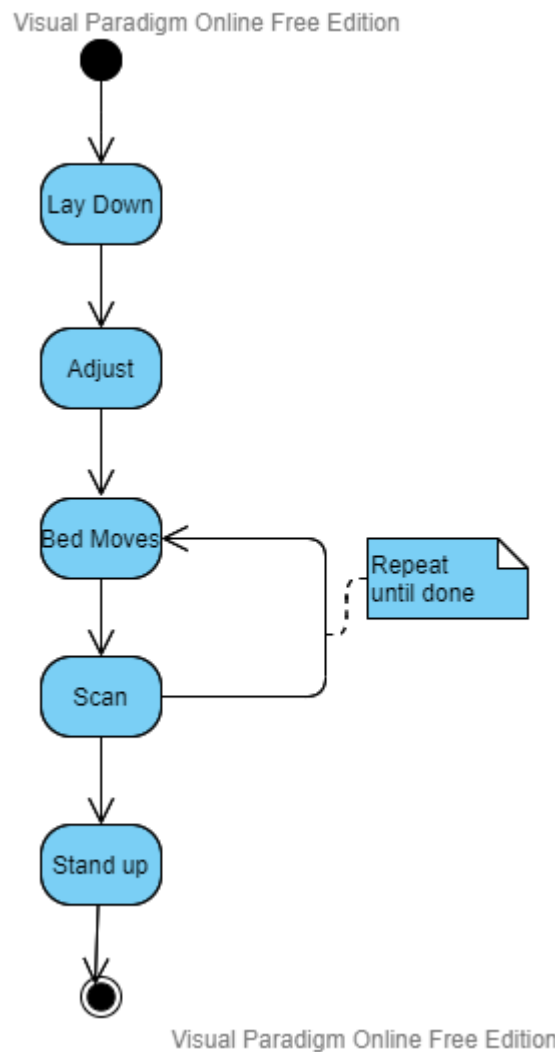
3.2 Use Case Diagram

For the Use-Case-Diagram we have 3 actors and 10 possible use-cases. The actors are the doctor, patient and technician.
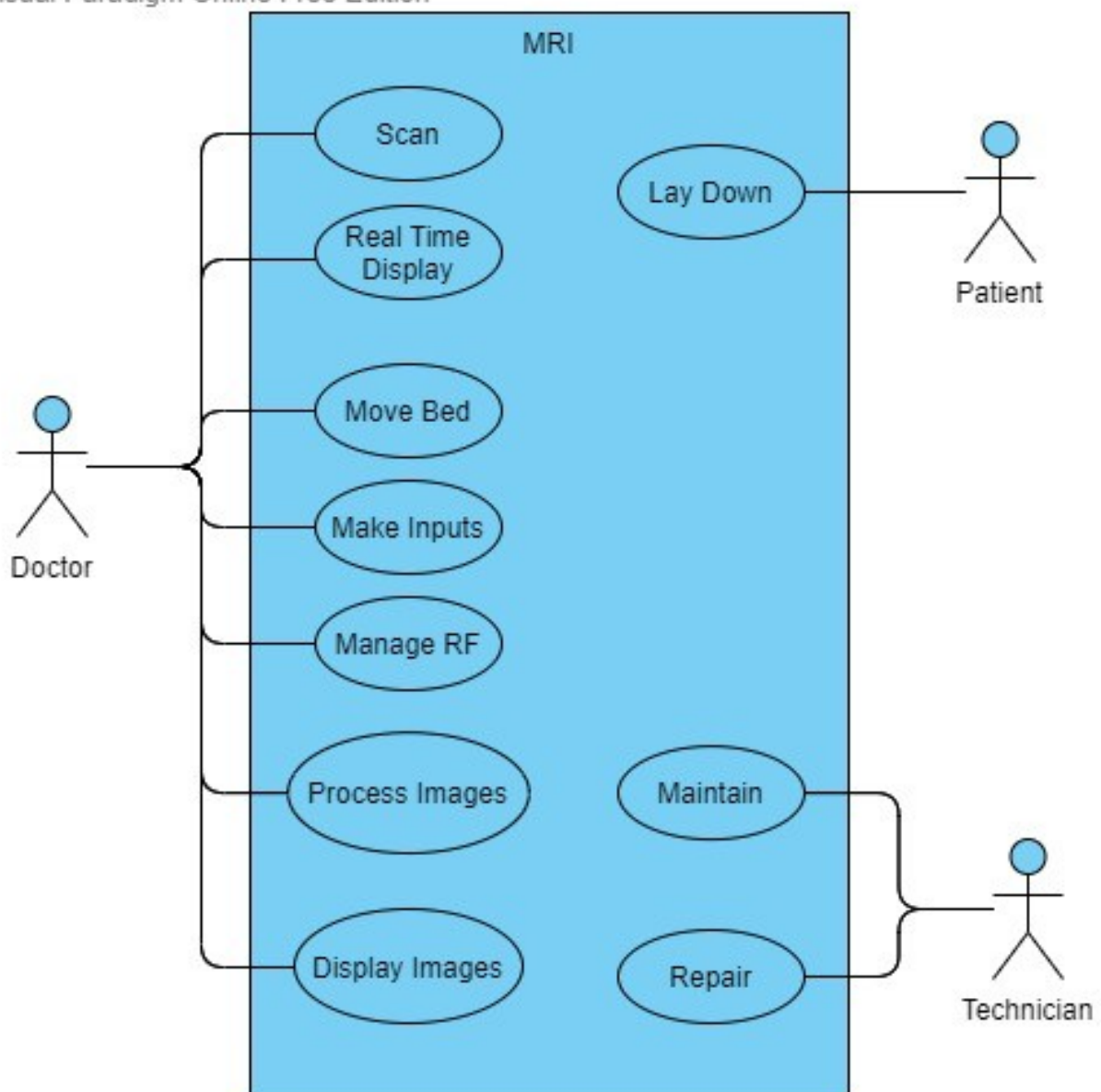
The patient only has to lay down as the more detailed procedure for them is described in the Activity-Diagram in 3.1.

The technicians use-cases describe the general maintenance and repair of the system. This is crucial to keep the system running flawlessly and ensure that in case of a failure that it is brought back to a state of operability.

The Doctor plays the most important part as they are the ones operating the system. Therefor they are able to control the system as a whole, which is represented in their ability to scan the patient or move the bed. Additionally they can view the scanned images in real time and control the images that are being displayed. Lastly they have control over the radio frequencies (RF) and can make other minor inputs.

Another minor adjustment they can make is the way images may be processed.

4. References

4.1 Components

[1]   https://www.ti.com/solution/mri-magnetic-resonance-imaging?
variantid=28801&subsystemid=29550

[2]   https://www.ti.com/solution/mri-magnetic-resonance-imaging?
variantid=28800&subsystemid=29542

[3]   https://www.ti.com/solution/mri-magnetic-resonance-imaging?
variantid=28802&subsystemid=29562

[4]   https://www.ti.com/lit/wp/spry178/spry178.pdf?ts=1653231642894&ref_url=https%253A
%252F%252Fwww.ti.com%252Fsitesearch%252Fen-us%252Fdocs%252Funiversalsearch.tsp
%253FlangPref%253Den-US%2526searchTerm%253Dhercules%2526nr%253D1602

[5]   https://www.ti.com/product/AM2732

[6]   https://www.maximintegrated.com/en/products/analog/data-converters/digital-to-analog-
converters/MAX19681.html

[7]   https://www.maximintegrated.com/en/products/analog/data-converters/analog-to-digital-
converters/MAX19588.html

[8]   https://www.maximintegrated.com/en/products/analog/data-converters/analog-to-digital-
converters/MAX19528.html

[9]   https://www.maximintegrated.com/en/products/analog/data-converters/analog-to-digital-
converters/MAX19527.html

[10]   https://www.maximintegrated.com/en/products/analog/data-converters/analog-to-digital-
converters/MAX19526.html

4.2 Elements

[]   https://www.fonar.com/su_siting.htm

[]   https://users.fmrib.ox.ac.uk/~stuart/thesis/chapter_2/section2_6.html

[]   https://eu.mouser.com/applications/medical-imaging-overview/