

Title: Automated Quality Assurance System for Clinical CT Systems

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Last Updated: 5/1/17

Function:

A software program will be designed and built to aid in computed tomography (CT) quality assurance testing and reporting. The software will process testing results and export them to a report analyzing the results and reporting corrections that must be made to the CT system. The report will also specify how the tests are conducted.

Client requirements:

The client would like the software to be capable of:

- Processing DICOM (Digital Imaging and Communication in Medicine) images that represent quality assurance test scans
- Automatically analyze images
- Store and manipulate user input
- Create reports from the test outputs into easy to read report using LaTeX [1]

The program will consist of a user-friendly MATLAB graphical user interface (GUI). Ideally, the program will be capable of doing several automated calculations and image processing for the client.

Design requirements:

The program will be developed in MATLAB and export a LaTeX-formatted text file which can be used to create a PDF. The client prefers that the program be capable of allowing user input of test values in whichever order the user chooses. The client would also like the option to input results manually.

1. Physical and Operational Characteristics

- a. **Performance requirements:** The program should have capabilities for a variety of tests, including daily, monthly, and annual tests. All uploaded images and/or data should have the ability to be saved in separate subfolders in reference to the report. The text file needs to be accessible to accommodate the addition of alternative tests for specialized scanners.

- b. **Safety:** Care should be taken to minimize visual strain by using sufficiently large font size and contrasting colors.
- c. **Accuracy and Reliability:** The software must be reliable in the sense that the program functions as designed during each use. The reports must be generated consistently throughout the use of the program and the program must function without crashes or bugs. The calculations computed by the program must be consistent and accurate. A pop-up window should appear as the calculations are being done for analysis by the user to ensure validity of the results before compilation in the PDF file.
- d. **Life in Service:** The program will be used indefinitely with the potential for modifications and improvements in the future.
- e. **Shelf Life:** The program will be able to run indefinitely.
- f. **Operating Environment:** The program will mainly be used by radiologists and physicists at the WIMR. However, the software may be shared in the future with other radiologists via forum boards.
- g. **Ergonomics:** The software should have a user-friendly interface that is intuitive. All text within the program and the PDF output must be well organized and readable.
- h. **Size:** N/A
- i. **Weight:** N/A
- j. **Materials:**
 - MATLAB
 - LaTeX
 - Sample testing data and reports will be provided
 - CT scanner available
- k. **Aesthetics, Appearance, and Finish:** The finished software package should have a clean and pleasing interface for the user. The software may be packaged into an executable for users without MATLAB.

2. Production Characteristics

- a. **Quantity:** One software program will be created.
- b. **Target Product Cost:** \$0 or cost of MATLAB licensing fees.

3. Miscellaneous

- a. **Standards and Specifications:** The tests outlined in the exported PDF will describe the testing procedures and report the testing results. The goal of this project is to automate the testing report to increase the consistency of the CT quality assurance testing reports in the department.
- b. **Customer:** The customer requests for the code to be well commented and easily modulated so others can understand and modify for their own use without

difficulty. Additionally, the user should be able to enter testing data in any order they choose.

- c. **Patient-related concerns:** In order to achieve an accurate CT scan with proper dosing, the CT scanner must be well tested prior to use. This program will help analyze CT system testing results and compile them in a report detailing the testing procedures and results. This report will be sent to technicians to fix the CT scanner.
- d. **Competition:** There are two software programs on the market that have many of the design specifications: ImageOwl and PIPSpro.

Image Owl is a cloud based system, which facilitates the retrieval of data and tracking trends over time, along with other features such as mobile apps [2]. While these features are convenient, they also greatly increase the price. Customization is another source of expense. Given their data analyses are specialized for Catphan® and Tomophan® phantoms, their more comprehensive and customizable testing options are more expensive [2].

PIPSpro, created by Standard Imaging Inc., provides quantitative analysis of scanner performance on a variety of phantoms sold by the same company [3]. Additionally, complexity of the program itself requires training to use properly [3]. As with Image Owl, the program does not lend itself to alterations and testing protocols are not included in the report.

References

[1] T. Szczykutowicz. "CT Scanner Annual Testing: East Clinic UWHC DHO (GE LS16 Pro)" Department of Radiology, University of Wisconsin-Madison. Jul. 2016.

[2] "Comprehensive QA Services in the Cloud," Image Owl, Inc. [Online]. Available: <http://www.imageowl.com/>. [Accessed: 09-Oct-2016].

[3] "PIPSpro Software," Standard Imaging, Inc.. [Online]. Available: <http://www.standardimaging.com/qa-software/pipspro-software/>. [Accessed: 09-Oct-2016].