Modules

This chapter lists and describes the major modules or applications that aggregate specific functionality and all together compose the System.

COM. Common Functionality

Provides authentication, authorization, forum and other functionality which is common to all other major modules.

EXS. Expert System

This module provides software tools to assist and guide local doctors and specialists in the process of lung cancer diagnostics.

IMA. Image Archive

Library of CT and other images with the related metadata and interface tools.

SCS. Skin Cancer Tools

Tools to diagnose and assess skin cancer.

Requirements hierarchy

This chapter provides a single hierarchy of functional and not functional requirements for the system.

- COM.1000 Provide user authentication and authorization
  - COM.1100 User must be authenticated by the popular social authentication systems
    - COM.1101 Provide authentication by Facebook
    - COM.1102 Provide authentication by Gmail
    - COM.1103 Provide authentication by Twitter
    - COM.1104 Provide authentication by any other popular system
  - COM.1200 Authenticated user must be not authorized by default (not active)
  - COM.1300 User can be authorized by the administrator
  - COM.1400 User can be authorized with one of the Roles supported
    - COM.1401 Authorization system must support USER role
    - COM.1402 Authorization system must support EXPERT role
    - COM.1402 Authorization system must support ADMIN role
- COM.2000 All services must have web access
- COM.3000 All service user interface must be multilingual
  - COM.3100 Main language for the Lithuanian users must be Lithuanian
  - COM.3200 Main language for the Belarusian users must be Russian
  - COM.3300 Main language for other users must be English
- COM.4000 Front page must provide the general information about the project
- COM.5000 Forum for doctors

- EXS.1000 Provide a guide (Expert System) to help doctors with the for faster and recommended lung cancer diagnostics process
  - EXS.1100 Manually define optional patient characteristics
    - EXS.1101 Provide patient age
    - EXS.1102 Provide smoking history
    - EXS.1103 Provide patient symptoms
    - EXS.1104 Provide patient risks
  - EXS.1200 Manually define diagnostic method and results for the patient
    - EXS.1201 Select diagnostics method
    - EXS.1202 Select observed method results based on examples and descriptions
  - EXS.1300 Suggest next diagnostic methods based on the best practice and recommendations for the given patient characteristic and/or previous diagnostic results
- EXS.2000 Print diagnostic results to PDF
- EXS.3000 Service must be restricted to registered and logged-in users approved medical or research facilities
- EXS.4000 Should be functionality to view/add/modify description of each characteristic of patient, each diagnostic method and of each result of method
  - EXS.4100 Description can contain formatted text and pictures
  - EXS.4200 Only users with EXPERT role can modify descriptions
- EXS.5000 Should be functionality to view CT images as example for each characteristic of patient, each diagnostic method and each result of method
- EXS.6000 Should be modified lung cancer diagnostics process

- IMA.1000 Provide access to the anonymous CT images archive
  - IMA.1100 Search in data table
    - IMA.1101 Filter image archive
    - IMA.1102 Filter by gender
    - IMA.1103 Filter by age
    - IMA.1104 Filter by disease code
    - IMA.1105 Filter by anonymized patient ID
    - IMA.1106 Filter by anonymized study ID
- IMA.2000 Access to full clinical and large scale images must be restricted to the logged users from approved medical or research facilities
- IMA.3000 All data must be anonymous

- o IMA.3100 Clinical data should not contain personal codes, first/last names, image/birth/death/examination dates and any other information that could help to relate the record to the person
  - o IMA.3200 Images should not contain personal codes, first/last names, image/birth/death/examination dates and any other information that could help to relate the record to the person
- IMA.4000 Service must be restricted to registered and logged-in users approved medical or research facilities
- IMA.5000 Should be functionality to view CT images in viewer
  - o IMA.5100 Should be functionality to control image viewer
    - ▪ IMA.5101 Scroll through series images
    - ▪ IMA.5102 Change white width and white central contrast
    - ▪ IMA.5103 Zoom image
    - ▪ IMA.5104 Pan image
    - ▪ IMA.5105 Toggle color invert
    - ▪ IMA.5106 Toggle pixel interpolation
    - ▪ IMA.5107 Reset white balance
    - ▪ IMA.5108 Reset zoom and image pan
  - o IMA.5200 Display image number on image viewer
- IMA.6000 Should be functionality to add tag with additional description for each image
  - o IMA.6100 Tag should contain title
  - o IMA.6200 Tag can contain annotation from expert system
  - o IMA.6300 Tag may have length, probe, ellipse, rectangle or angle form
  - o IMA.6400 Tags should be displayed on current image in image viewer
  - o IMA.6500 Should be functionality to view selected tag information
  - o IMA.6600 Should be functionality to modify tag titles
  - o IMA.6700 Tags may be hidden
  - o IMA.6800 Should be functionality to view/add/modify description of each tag
    - ▪ IMA.6801 Description can contain formatted text and pictures
    - ▪ IMA.6802 Only users with EXPERT role can modify descriptions
  - o IMA.6900 Only users with EXPERT role can modify tags

Requirements description

In this chapter, requirements are described in detail.

COM.1000 Provide user authentication and authorization

All the users that gain access to other parts of the System than the front page must be authenticated and authorized. This function provides means and tools to authenticate users by using popular open systems and to authorize them by the appropriate role.

COM.1100 User must be authenticated by the popular social authentication systems

Occasional users who want to get access to the system can use their account of popular social systems to register themselves in the system. Once this has done administrator will be able to authorize users to use system by the appropriate level.

COM.1101 Provide authentication by Facebook

Facebook is the popular social network so anyone who have Facebook account can use it to authorize to the system. System will store required authentication tokens and other required information for authorization and later logins.

COM.1102 Provide authentication by Gmail

Gmail (Google+) is the popular email system and social network. Thus anyone who have Gmail account can use it to authorize to the system. System will store required authentication tokens and other required information for authorization and later logins.

COM.1103 Provide authentication by Twitter

Twitter is the popular messaging network so anyone who have Twitter account can use it to authorize to the system. System will store required authentication tokens and other required information for authorization and later logins.

COM.1104 Provide authentication by any other popular system

Any other popular social networks and systems could be used to authenticate users to the system. System should store all the required authentication tokens for authorization and later logins.

COM.1200 Authenticated user must be not authorized by default (not active)

Then a user logs in for the very first time s/he is required to fill in the Front page must provide the general information about the project account form with some fields, like professional email, address, institution, motivation, etc. to be used later for authorization. After user saves, the form her/his account is not active. It still has to be authorized by the ADMIN. Email message must be sent to all ADMIN role having users to proceed with action.

COM.1300 User can be authorized by the administrator

ADMIN can review user information and grant (authorize) user with one of the roles: USER, EXPERT or ADMIN.

COM.1400 User can be authorized with one of the Roles supported

User can be granted with one of the Roles (see below).

COM.1401 Authorization system must support USER role

USER role allows grantee to use all the system parts but does not allow modifying anything. I.e. it is not allowed to write into forum not create image tags. However, it is OK to view all the information.

COM.1402 Authorization system must support EXPERT role

EXPERT user can do everything what USER can but s/he can discuss in forum and create/edit image tags.

COM.1402 Authorization system must support ADMIN role

ADMIN user can do everything what EXPERT does but in addition to that, s/he can change other user Roles (change authorization level).

COM.2000 All services must have web access

All the parts of the system must have Web access and should be accessible by the general modern browser.

COM.3000 All service user interface must be multilingual

User interface must be multilingual and must support at least 3 languages: English, Russian and Lithuanian.

COM.3100 Main language for the Lithuanian users must be Lithuanian

If user is identified as Lithuanian one, s/he must be provided with Lithuanian interface by default. If s/he chooses a different language than system should remember this and use it for latter logins.

COM.3200 Main language for the Belarusian users must be Russian

If user is identified as Belorussian one, s/he must be provided with Russian interface by default. If s/he chooses a different language than system should remember this and use it for latter logins.

COM.3300 Main language for other users must be English

If user is not identified as Lithuanian nor as Belorussian, s/he must be provided with English interface by default. If s/he chooses a different language than system should remember this and use it for latter logins.

COM.4000 Front page must provide the general information about the project

Front page must list general information about the project, partners and other general information in different languages.

COM.5000 Forum for doctors

For doctors should be used special system for exchange experience in diagnostic and treatment of disease. User can add question in forum. Other user can add answer. Questions and answers can be with pictures, links, and video.

EXS.1000 Provide a guide (Expert System) to help doctors with the for faster and recommended lung cancer diagnostics process

Functionality provides the system or list of rules, which help with diagnostics of lung cancer.

EXS.1100 Manually define optional patient characteristics

On first diagnostic stage the doctor uses only viewable characteristics and symptoms of patients.

EXS.1101 Provide patient age

Expert system must be able to accept patients' age to include this information into the reasoning calculations.

EXS.1102 Provide smoking history

Expert system must be able to accept patients smoking history to include this information into the reasoning calculations.

EXS.1103 Provide patient symptoms

Expert system must be able to accept patients' symptoms to include this information into the reasoning calculations.

EXS.1104 Provide patient risks

Expert system must be able to accept patients' risks to include this information into the reasoning calculations.

EXS.1200 Manually define diagnostic method and results for the patient

Usually EXS will be used as system with recommended next method for diagnosis, but also should be functionality to use some diagnostic methods manually.

EXS.1201 Select diagnostics method

Users must be able to select diagnostics method from the list provided. System must have most of the modern diagnostics methods and results listed in the GUI.

EXS.1202 Select observed method results based on examples and descriptions

After selecting the method user must be able to select (checkbox) diagnostics results, s/he has observed and after this, s/he must be provided with the next recommendations: next diagnostics method(s) or final diagnosis. All calculations must be based on the best practice and recommendations.

EXS.1300 Suggest next diagnostic methods based on the best practice and recommendations for the given patient characteristic and/or previous diagnostic results

Expert System must have all the required machinery to do the reasoning calculations based on the data provided – patient characteristics and previous diagnostic method results. Calculations must provide a recommended next diagnostics method or the final diagnosis. All calculations must be based on the best practice and recommendations. All steps must be well described and illustrated with appropriate images to help the selection process.

EXS.2000 Print diagnostic results to PDF

User must be able to print her/is results to PDF for further usage.

EXS.3000 Service must be restricted to registered and logged-in users approved medical or research facilities

Service must be restricted/limited access to the identified registered and logged in users that are known to access the service from the medical facility or the research institution.

EXS.4000 Should be functionality to add description of each characteristic of patient, each diagnostic method and of each result of method

Doctors can add description of each element in EXS. Examples: A method description with attached manual or with best practices for diagnostic method. Can be described each result of diagnostic method, to understand which result should be selected in same situation. Descriptions should be help-dialog for users.

EXS.4100 Description can contain formatted text and pictures

For description should be used Rich Text functionality, where can be used formatted text, pictures, links, video.

EXS.4200 Only users with EXPERT role can modify descriptions

The management of description should be accessible only for user with EXPERT role. Others user can only view descriptions.

EXS.5000 Should be functionality to view CT images as example for each characteristic of patient, each diagnostic method and each result of method

Doctors can view CT images of each element in EXS. Example: A result of diagnostic method can be compared with images and diagnosis from image archive. CT images viewer bound with EXS should be help-dialog for users.

EXS.6000 Should be modified lung cancer diagnostics process

The logic of EXS can be modified, because can be used new diagnostic method or will be discovered the new logic in rules. To add new logic rules, diagnostic methods, results, patient characteristics needed special knowledge.

IMA.1000 Provide access to the anonymous CT images archive

Provide access to the anonymous CT images archive with limited clinical data to perform future lung cancer statistical and diagnostics analysis.

IMA.1100 Search in data table

Provides search in CT image data base

IMA.1101 Filter image archive

Users should be able to filter images

IMA.1102 Filter by gender

Users should be able to filter images by patient's gender.

IMA.1103 Filter by age

> Users should be able to filter images by patients at the time of examination.

IMA.1104 Filter by disease code

> Users should be able to filter images by disease code.

IMA.1105 Filter by anonymized patient ID

> Users should be able to filter images by anonymized patient ID.

IMA.1106 Filter by anonymized study ID

> Users should be able to filter images by anonymized study ID.

IMA.2000 Access to full clinical and large scale images must be restricted to the logged users from approved medical or research facilities

> Full filtered results and information must be restricted/limited access to the identified registered and logged in users that are known to access the service from the medical facility or the research institution.

IMA.3000 All data must be anonymous

> There should be not any personal data about patients and their studies.

IMA.3100 Clinical data should not contain personal codes, first/last names, image/birth/death/examination dates and any other information that could help to relate the record to the person

> For the ethical and criminal reasons all, the information provided by the image archive service must be anonymous and cannot contain any information that could help to relate a record to the actual person. This concerns personal, social, etc. codes, first/last/middle names, any exact dates, meaningful medical or database record Ids. No information must leave the boundary of medical facility and the mapping must remain in the facility.

IMA.3200 Images should not contain personal codes, first/last names, image/birth/death/examination dates and any other information that could help to relate the record to the person

> For the ethical and criminal reasons all, the information provided by the image archive service must be anonymous and cannot contain any information that could help to relate a record to the actual person. This concerns personal, social, etc. codes, first/last/middle names, any exact dates, meaningful medical or database record Ids. No information must leave the boundary of medical facility and the mapping must remain in the facility. Images must be processed accordingly to remove the sensible information from raster images.

IMA.4000 Service must be restricted to registered and logged-in users approved medical or research facilities

> Service must be restricted/limited access to the identified registered and logged in users that are known to access the service from the medical facility or the research institution.

IMA.5000 Should be functionality to control image viewer

> Should be functionality to view images in CT image viewer with additional controls.

IMA.5100 View study and series images

Should be functionality to control view images in CT image viewer with additional controls.

IMA.5101 Scroll through series images

Users should be able to scroll though series images to view full CT image set.

IMA.5102 Change white width and white central contrast

Users should be able to change white width and white central contrast settings for the image viewer.

IMA.5103 Zoom image

Users should be able to zoom image in the image viewer.

IMA.5104 Pan image

Users should be able to pan image in the image viewer.

IMA.5105 Toggle color invert

Users should be able to invert color and switch it back in the image viewer.

IMA.5106 Toggle pixel interpolation

Users should be able to enable and disable pixel interpolation for image in the image viewer.

IMA.5107 Reset white balance

Users should be able to reset white balance in the image viewer.

IMA.5108 Reset zoom and image pan

Users should be able to reset zoom and pan in the image viewer.

IMA.5200 Display image number on image viewer

Users should be able to series image number in the image viewer..

IMA.6000 Should be functionality to add tag with additional description for each image

Users can create tag for each image in IMA. Examples: Can be described what is in the image.

IMA.6100 Tag should contain title

Tags should have title to understand the difference between them.

IMA.6200 Tag can contain annotation from expert system

Tags may have annotations from expert system to make possible to find tag by annotation from expert system.

IMA.6300 Tag may have lenth, probe, ellipse, rectangle or angle form

Several tag forms are suited for different purposes.

IMA.6400 Tags should be displayed on current image in image viewer

All created tags are displayed in image viewer for each image.

IMA.6500 Should be functionality to view selected tag information

Data table with information about each tag.

IMA.6600 Should be functionality to modify tag titles

Modify tag titles in tag information preview.

IMA.6700 Tags may be hidden

Should be functionality to hide tags, as many tags on one image can be confusing.

IMA.6800 Should be functionality to add description of each tag

Doctors can add description of each tag. Descriptions should be help-dialog for users.

IMA.6801 Description can contain formatted text and pictures

For description should be used Rich Text functionality, where can be used formatted text, pictures, links, video.

IMA.6802 Only users with EXPERT role can modify descriptions

The management of description should be accessible only for user with EXPERT role. Others user can only view descriptions.

IMA.6900 Only users with EXPERT role can modify tags

The management of tags should be accessible only for user with EXPERT role.