

NYU CAT (CT) Scan Web Application Users Guide

Version: 1.0

Changelog

<i>Version</i>	<i>Comments</i>	<i>Revision Date</i>	<i>Author</i>
1.0	Initial Revision	5-Jun-06	C. Mattmann

References

1. EDRN Informatics Working Group. *NYU CAT (CT) Scan Web Application Deployment Guide*, version 1.1, June 05, 2006.
2. Hibernate Query Language,
http://www.hibernate.org/hib_docs/reference/en/html/queryhql.html.

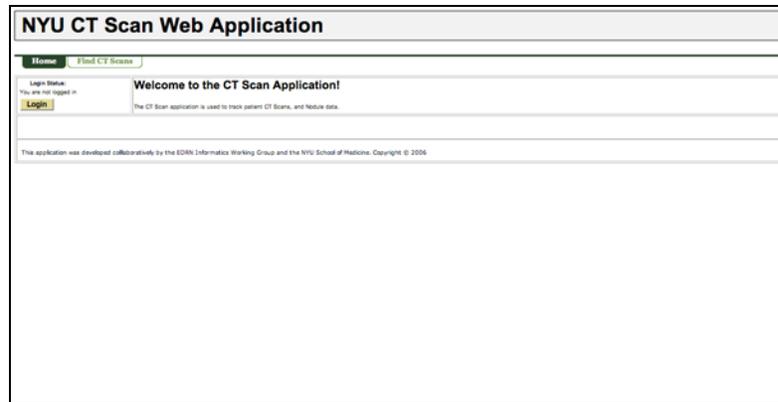


Figure 1. Main Screen of the CTScan application

1. Accessing the system

Depending upon where the CTScan system was deployed (see [1] for more details), most likely you were given a url of the form:

`http://<host>:<port>/ctscan/`

where <host> represents the actual machine name that the CTScan application was running on. For the purposes of the User's Guide, we'll assume that <host> corresponds to `gcr.med.nyu.edu`, and that the <port> is 8443. We'll also assume that we're using the secure HTTP (HTTPS) protocol to access the site. To access the system, navigate to:

<https://gcr.med.nyu.edu:8443/ctscan/>

You should be presented with a screen resembling Figure 1.

2. User capabilities

User capabilities are accessed via authentication to the system. Authentication involves providing your NYU LDAP login name and password to the system so that it can properly identify who you are, and what permissions you have (as shown in Figure 2). Permissions are controlled via *roles* which govern what capabilities you can access. Below, the key roles for the system are identified.

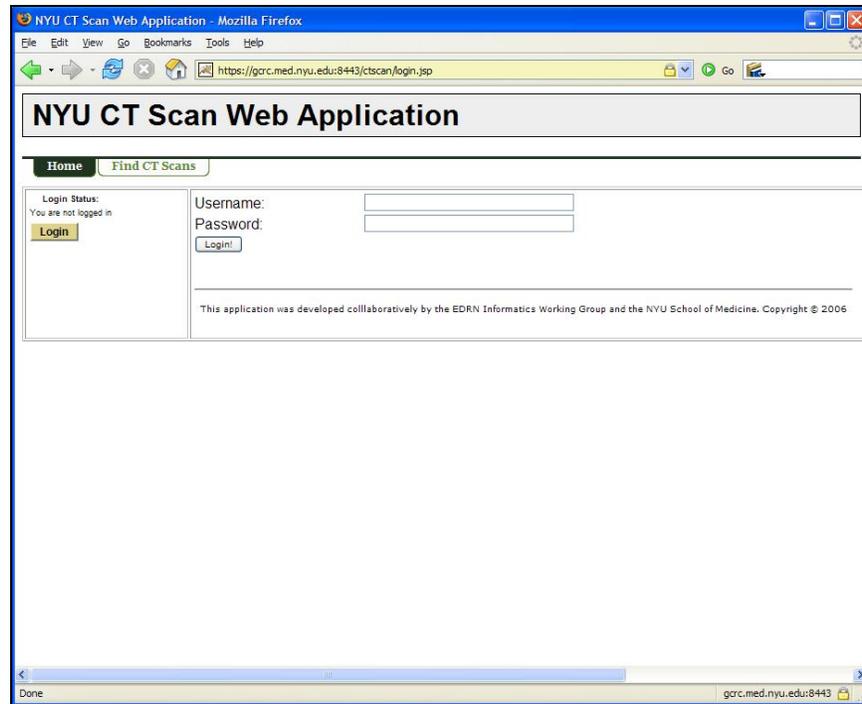


Figure 2. Login Screen for the CTScan application

2.1 Roles

2.1.1 Admin

The *Admin* role is assigned to the administrators of the system (a list of which is provided in the middle-left portion of the screen when logged into the system). A user with the *Admin* permissions has the ability to modify, add, and delete CT Scan data, and controlled values present in the data forms. Additionally the admin has the ability to create new roles, and assign those roles to the Users of the system. The administrator can also search through CTScans.

2.1.2 Modifier

The *Modifier* role is assigned to any user that the administrators of the system desire to have the ability to add and modify CT Scans, and Nodule information from the system. Modifiers are additionally allowed to search for CTScans.

2.1.3 Browse

The *Browse* role is assigned to any user that the administrators of the system wish to have the ability to only search through CTScans. Browse users are not allowed to modify, or add any of the CTScan data in the system.

2.1.4 Guest

The *Guest* role is the default role assigned by the CTScan system to any user that has no saved permissions. Guests can do little other than browsing the main page of the system.

2.2 Adding a new CT Scan

A User adds a new CT Scan by first logging into the system. After logging in, the user should click on the **Add Scan** tab located in upper navigation portion of the web site once logged in (highlighted in Figure 3):

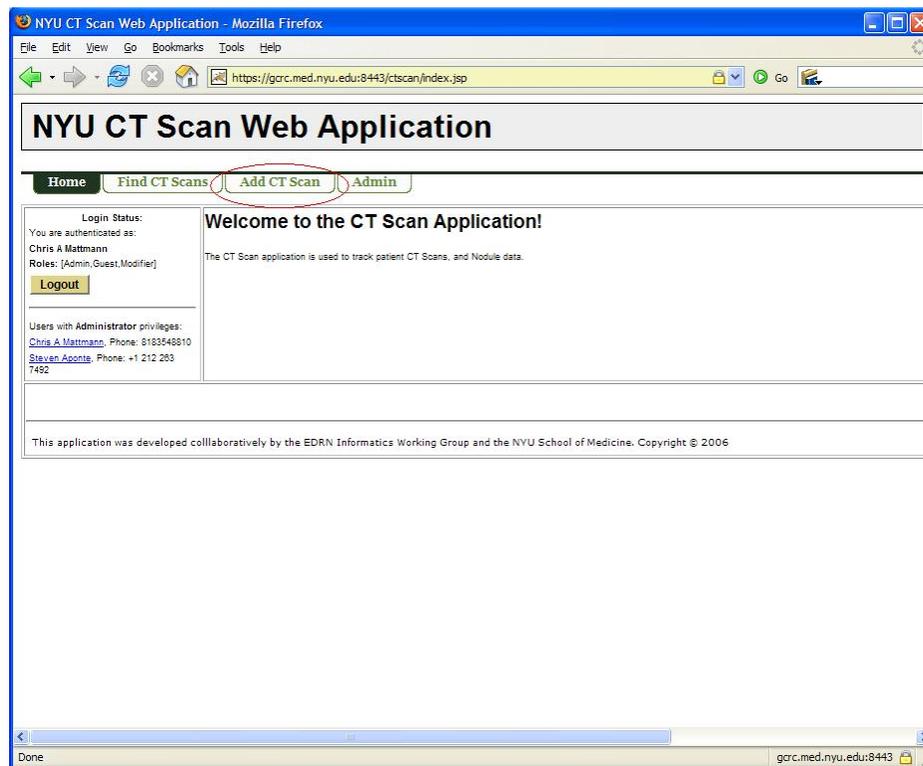


Figure 3. Link to addScan page

Once the user clicks on the add scan page, she will be taken to the first of a 3 step workflow for adding scan information to the system. The workflow is depicted in graphical form below:

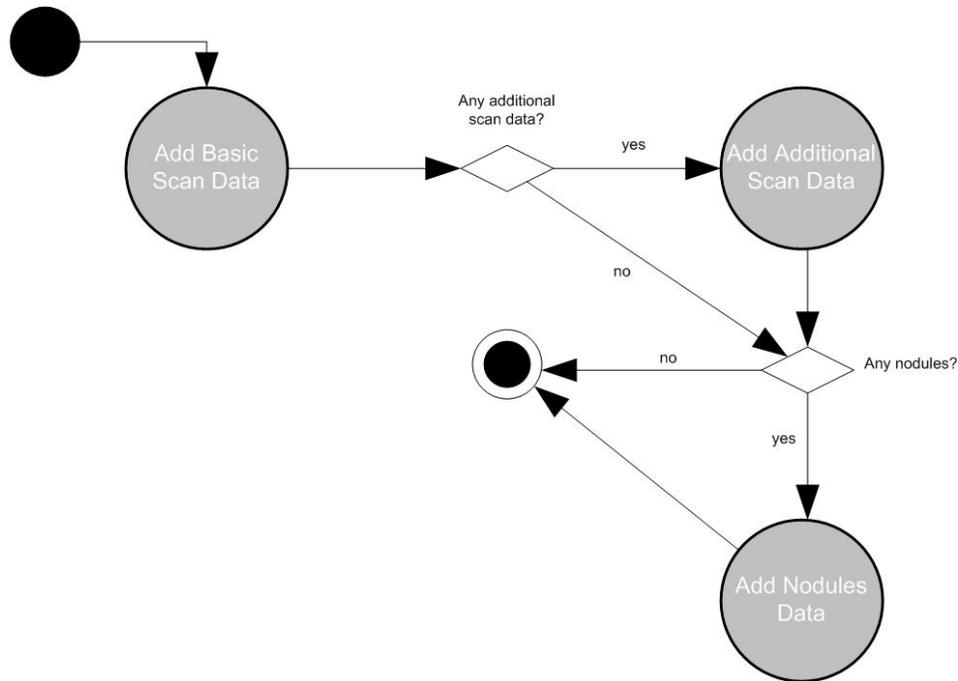


Figure 4. Add Scan data workflow

In words, the user is first presented with a form that asks the user for basic CT Scan data. The data includes the following fields:

Table 1. CT Scan basic data fields

<i>Field</i>	<i>Description</i>
Study ID Number	unique patient ID number Other abnormalities, besides nodules
Study Date	date of CT scan
Study ID Letter Label	identifies type of visit--initial, CT follow-up, annual, etc.
No Change?	used to speed data entry. Some CT scans will not show any changes. This field might be changed to include other options, such as 'new nodule'
Number of Nodules to Submit	Number of Nodules associated with CT Scan to record data for
Radiologist	radiologist who reviewed scan
Reading Date	date the radiologists reviewed scan
CT Scan Location	where CT done (one of 3-4 locations)
CT Scan Type	Type of CT
Additional Review By	Some CTs are reviewed a 2nd or 3rd time, by a radiologist or pulmonologist
Disk/Exam #	Which disk images are stored on

EDRN INFORMATICS WORKING GROUP

5-Jun-06

Follow Up For What?	What on the CT requires follow-up
Follow Up In	When the follow-up should be (2-12 months) usually will be months.
Do you have any additional data to submit?	Yes/No

After adding basic CT Scan data, depending upon the user's answers to *Number of Nodules to Submit* and *Do you have any additional data to submit* the workflow may change. If the user answered yes to having additional data to submit, then the user is taken to the **add additional CT Scan data** page, where the user is asked a series of questions about additional Scan findings. Each field is a radio button, and by default all of the answers are set to "No". If the user did not select add additional data, then the system checks if the user input a nodule number > 0: if so, then the system moves the user to the **Add Nodules** page. The user is additionally presented with a set of questions and answers and input fields to capture information about nodules associated with a CT Scan. After both nodule data, and additional data have been checked for, the scan has successfully been added.

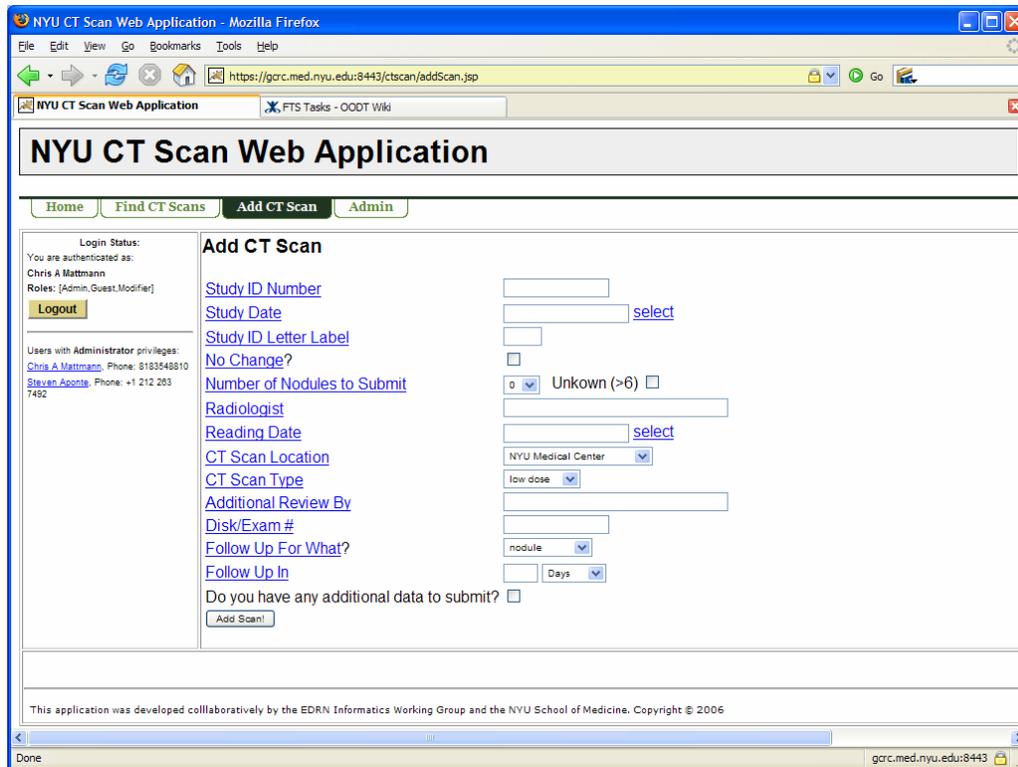


Figure 5. Adding basic CT Scan data

Figure 6. Add Nodules to CT Scan page

2.3 Searching for CT Scans

Searching for CT Scans is performable by users with the *Browse* role permissions, or the *Admin* permissions. The user should click on the **Find CT Scans** tab in the upper portion of the navigation bar when she is logged into the system. This will bring the user to a page with a free text query box in which the user can enter a free text query. Queries in the CT Scan system are formulated using the Hibernate Query Language, or *HQL*. There are many excellent sources of information (in particular [2] is quite good) about HQL. This user guide provides a brief overview of how HQL is used in the CT Scan system, and how the user can formulate queries to find data. The users of the system should familiarize themselves with the detailed documentation in [2] for advanced mastery of the query language.

In the CT Scan system, data is treated as objects. So, there is an inherent object model behind the design and implementation of the CT Scan system. The object model is shown in the second section of the Appendix). In the object model, there are three main aggregate classes of information: **CTScan**, **CTScanAdditionalData**

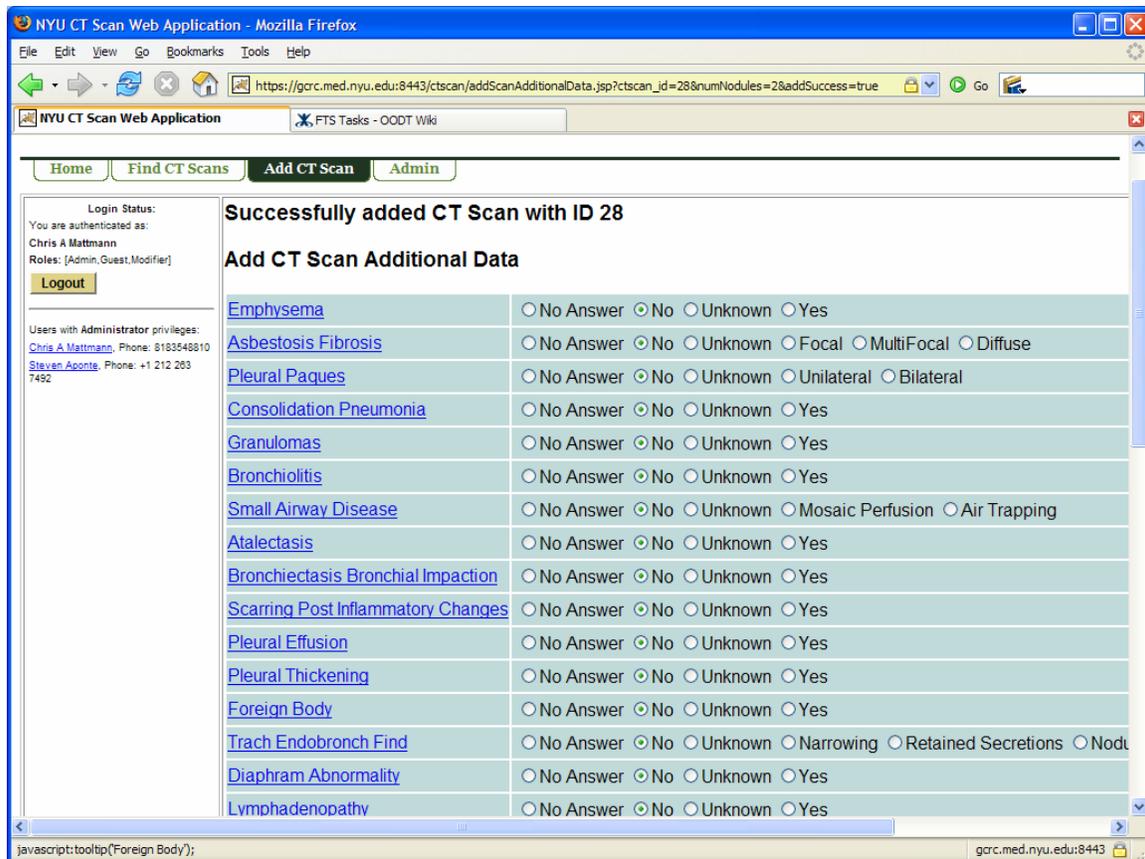


Figure 7. Adding CT Scan additional data

and **Nodule**. Each of these information classes has a set of attribute names and respective data types associated with them. This object model is the main driver for the design and implementation of the CT Scan query system. If the user can understand the Object Model, then querying becomes fairly simple.

Queries against the CT Scan system are **CTScan** centric. That is to say, all queries are from the perspective that the user is searching for CTScans. By default, the system provides a default object instance, called **c** which represents an instance of the **CTScan** object class. From the CTScan object instance, a user can formulate queries against any of the nodule data, or the additional scan data, or any of the other object classes: because they are all related to **CTScan**.

Consider the following highly simple query:

A User is interested in all CT Scans where the radiologist “Chris Mattmann” reviewed the scan

This query can be translated to a CT Scan query in the following fashion:

```
c.radiologistUid = 'Chris Mattmann' OR c.addtlRadiologistUid = 'Chris Mattmann'
```

EDRN INFORMATICS WORKING GROUP

5-Jun-06

To understand the formulation of the above query, the user need only understand the object model. Looking at the object model, the user can see that the **CTScan** object has two fields, one called “radiologistUid”: this corresponds to the user id of the radiologist who reviewed the scan, and another called “addtlRadiologistUid”, which corresponds to the additional radiologist who reviewed the scan (if any). Then, remembering that there is a default object instance called **c**, the query is formulated by using an OR’ed expression that does a match on the value “Chris Mattmann” for both of the above aforementioned fields.

Even more complex queries can be performed. For example, consider the following query:

A User is interested in any CT Scans in the system in which a nodule was identified with a pleural surface distance of 0.2mm

This query can be translated to a CT Scan query in the following fashion:

```
c.nodules.distancePleuraSurface = 0.2
```

At first blush, this query might look even simpler than the first example. However, upon closer examination, notice that we were able to query *another object class’s* attributes, simply through the object relation that *every CT Scan has a list of Nodules called “nodules”*. Looking at the **CTScan** object class in more detail, the user can see that every object class present in the object model is accessible via the **CTScan** object class. This allows a user to have a top-down, flexible query approach to finding data in the CT Scan system. The Appendix provides a list of sample queries provided by Brendan Phalan, translated into CTScan queries. The sample queries are provided for illustration, and to instruct the user how to query the system for CTScan data.

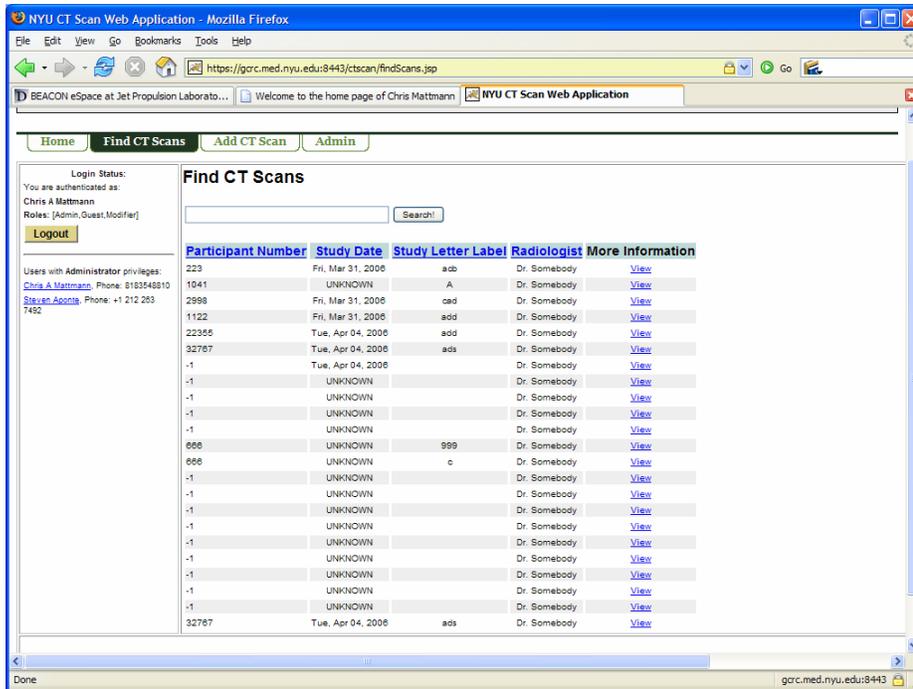


Figure 8. Result list from quick search

2.4 Modifying an existing CT Scan

Modifying an existing Scan involves first searching for the Scan using the free text query capabilities described in Section 2.3. The reader should examine that section before reading this one.

Once a scan has been found (as shown in Figure 8), click on the *View* link underneath the **More Information** column on the right hand side of the result list. After clicking on *View*, a new window will pop open allowing the user to browse the detailed information

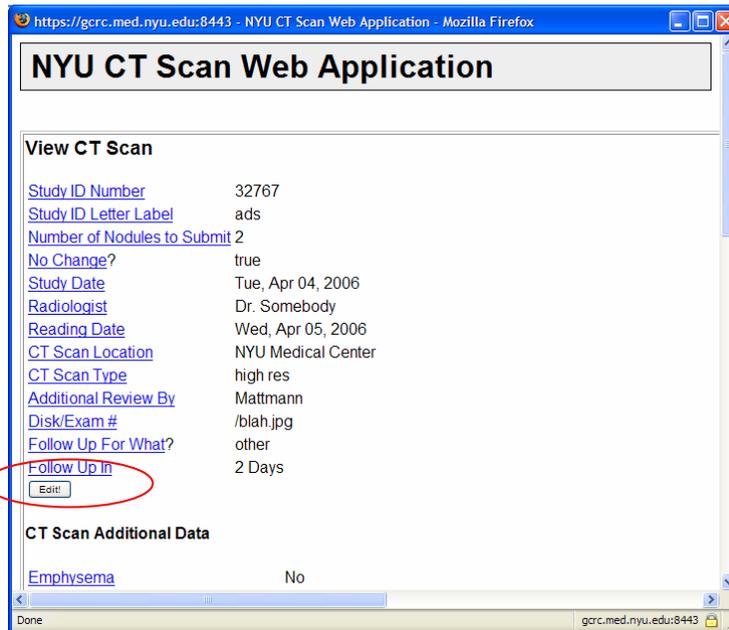


Figure 9. Edit button on view scan page

about the CT Scan. The CT Scan data is broken down into the basic CT Scan data (shown at the top of the opened page), the additional CT Scan data (if any) that is

EDRN INFORMATICS WORKING GROUP

5-Jun-06

shown in the middle of the page, and the Nodule data (if any) that is shown at the bottom of the page. At the bottom of each data table, a small button called “Edit”(highlighted in Figure 9) will be available. The “Edit” button is only available if the user has either the *Admin* or *Modifier* roles for the system.

Once the “Edit” button is identified, then the user should click on the button for the particular piece of CT Scan data that she would like to edit (e.g., Additional Data, or Nodule data, or Basic CT Scan data), and the page will refresh with an edit form allowing the user to modify the particular subset of information for the selected CT Scan.

The edit form looks exactly like the add data form, however, the values within it will be automatically populated from the existing information captured in the database.

3. Appendix

3.1 Example Queries

1. *The User is interested in finding CT Scans where Study ID Number is **99233** and Study ID Letter Label is **c** or scan type is **low dose**.*

CT Scan query:

```
c.participantNum = 99233 AND c.ctscanLabel = 'c' OR  
c.scanType.scanType = 'low dose'
```

2. *The User is interested in finding CT Scans where the study date was between **April 2006 and June 2006***

CT Scan query:

```
c.studyDate > '2006-04-01' AND c.studyDate < '2006-06-01'
```

3. *The User is interested in the number of unique scans **with nodules***

CT Scan query:

```
c.nodules.id IS NOT NULL
```

3.2 Object Model

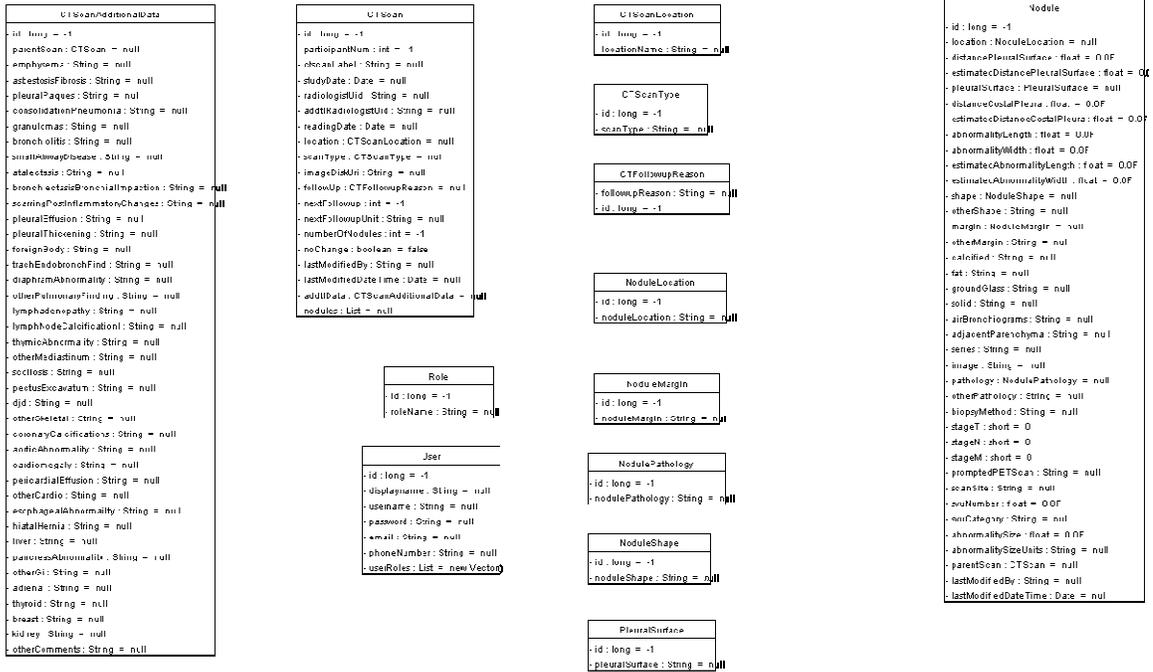


Figure 10. CT Scan Object Model