Annexure B

GUI for floor plan analysis and retrieval

In this Chapter, a software interface for the task of content-based floor plan retrieval is discussed. The software works in the following manner:

1. The user chooses a sample floor plan image and uploads it to the server.

2. The retrieval engine extracts features from the query sample and matches with all the samples of the database.

3. The retrieved samples are rank ordered and shown to the user.

The software has a Graphical User Interface (GUI) with which the user can interact with the system and retrieve similar floor plans from the database. The software has two operational modes, which are (i) detailed mode, and (ii) direct mode. In the detailed mode, depending on the users' choice the intermediate steps of floor plan retrieval such as, segmentation, graph creation with nodes as segmented rooms and adjacencies as relations between the rooms, and finally retrieval based on the features extracted from the floor plans are shown in this GUI. On the other hand, in the direct mode the intermediate steps are not shown, and only the final result is displayed.

B.1 SYSTEM ARCHITECTURE

The web-based interface, which runs in a client server mode, has been developed to facilitate the framework for semantic retrieval of floor plans. The proposed system runs on Windows 7/XP and requires a few seconds to retrieve the rank-ordered results from the repository of floor plans. Figure B.1 shows the overall architecture for the framework. Developed under a client-server paradigm, the retrieval framework has two types of users to access the application, namely normal user and the administrator. A normal user is allowed to browse the system and perform queries, select whether he/she wants to get results of all the intermediate steps in the framework or only the final retrieval results, place a request to add a new floor plan to the repository, etc. An administrator on the other hand has all the access of the functionalities provided to a normal user, and in addition has the privilege to see the repository updation requests sent by the normal user and add/remove user accounts etc. The types of user access are controlled by a backend user database maintained using Microsoft Access. The retrieval portal is developed using HTML5, JavaScript, CSS. Apache webserver hosts the webpages, while Tomcat Java Server hosts Java servlets for receiving the query provided by the user.

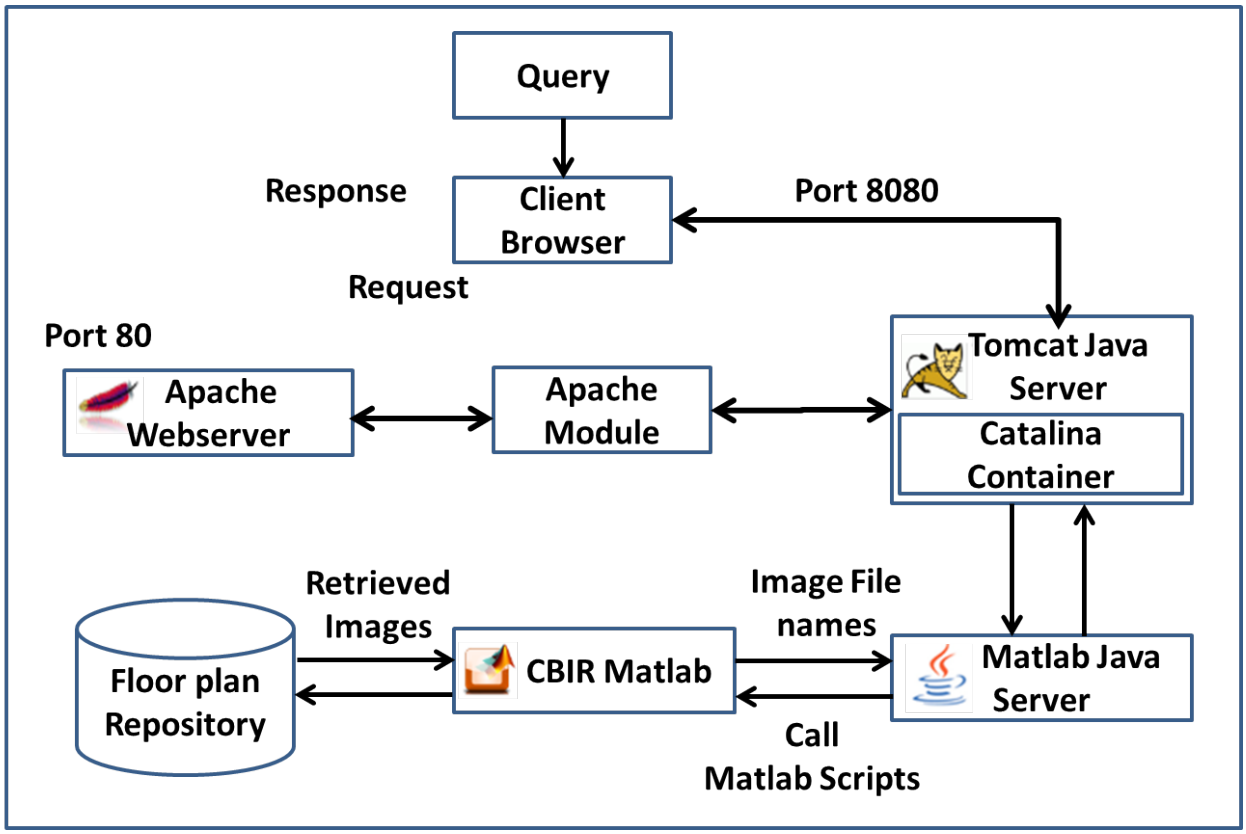

Figure B.1. : Architecture of the developed software for floor plan retrieval.

B.2 SOFTWARE FUNCTIONALITY

Figure B.2 depicts the sequence diagram of the developed software. There are five primary objects. They are: (i) user, (ii) host computer, (iii) Graphical User interface (GUI), (iv) Matlab workspace, and (v) the floor plan database. The user initiates the interaction between the software and the outside world by selecting a query floor plan image from the host computer. Through the GUI the query image is submitted to the Matlab workspace. All the necessary modules are developed in Matlab as .m files. The feature extraction, segmentation, matching and rank ordered list is done in the Matlab workspace. Based on the rank ordered list, floor plans are retrieved from the database and shown to the user. The software also has a functionality to allow the user to choose the number of floor plan samples to be displayed. Depending upon the users' choice (the value of k), the appropriate number of floor plans are shown to the user. In the next section, screen-shots of the key components of the software and their description is presented.

B.3 SCREEN-SHOTS OF THE FLOOR PLAN RETRIEVAL FRAMEWORK

Initially, when the user launches the application he/she comes across the basic screen prompting the user to select a floor plan from the repository to query into the retrieval framework as shown in Fig. B.3. As shown in Fig. B.3, there are three place holders to host the three different type of images. It can be observed that the "Search" button at the bottom of the interface is disabled at the beginning to ensure that the search is not made on null objects.

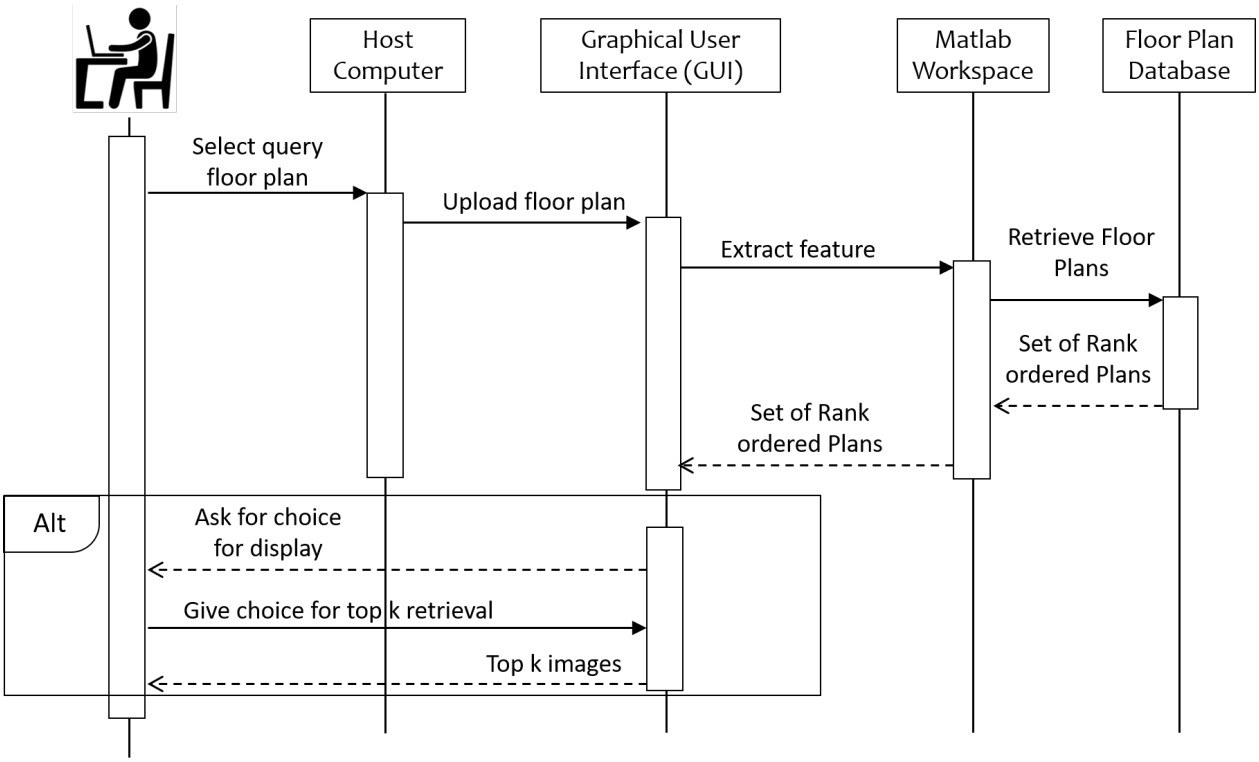

Figure B.2. : Sequence diagram depicting the overall flow of the software.

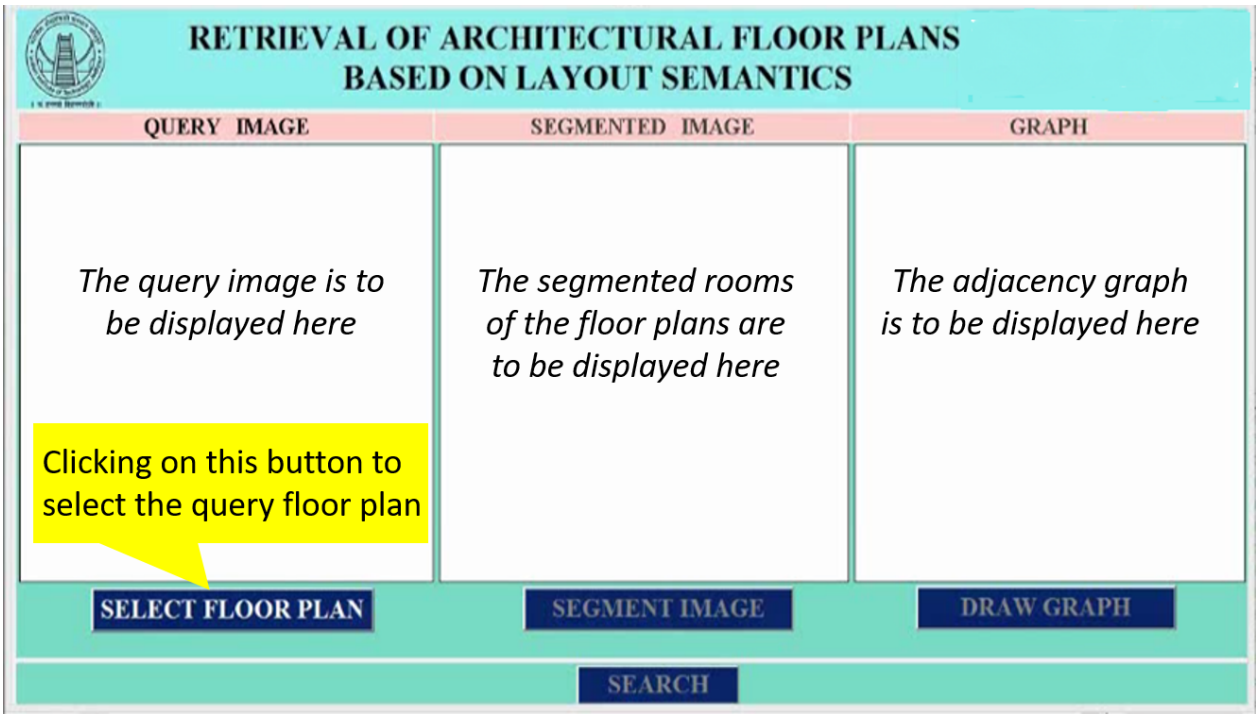

Figure B.3. : Screen prompting the user to select a floor plan of his/her choice.

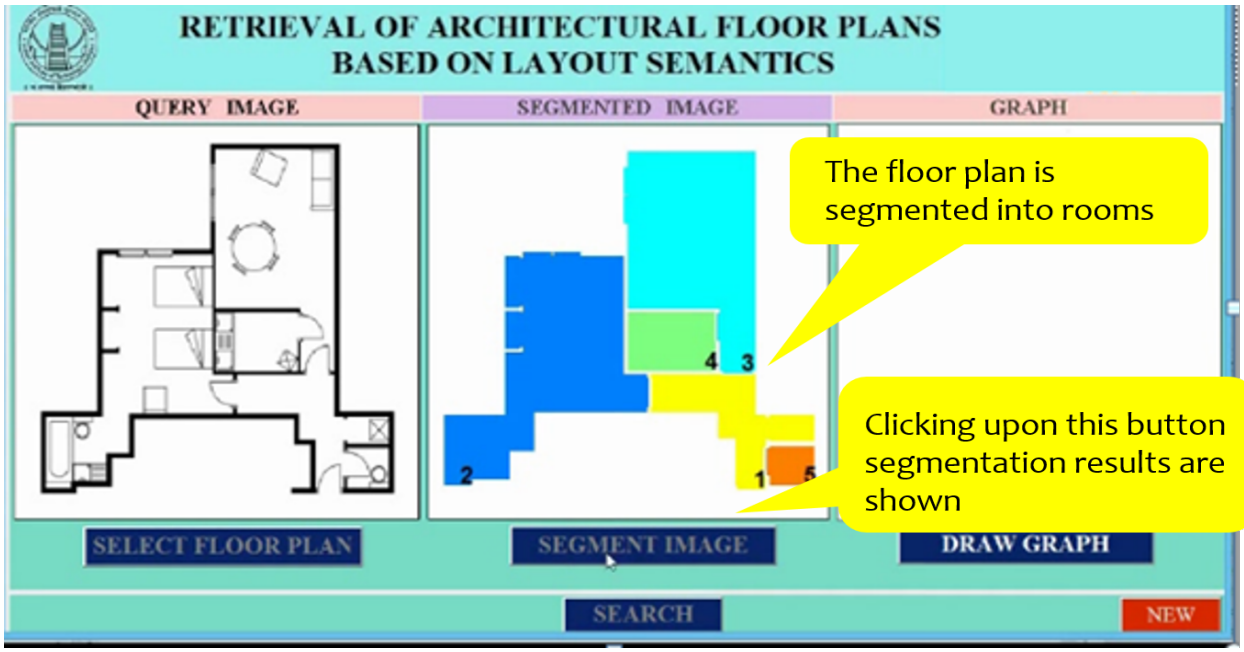

Figure B.4. : Segmentation of the selected plan into labeled rooms

Once the floor plan is chosen and shown in the appropriate place holder the user has the option to choose one of the two modes, i.e. direct or detailed mode. If the user chooses the detailed mode then the intermediate results will be shown in the appropriate place holders. Under the detailed mode, the next task is to segment the floor plan into meaningful entities like rooms and separating it from the decor elements present inside the rooms to further derive the relations between them. Figure B.4 depicts such a scenario, where the intermediate result is shown. Since

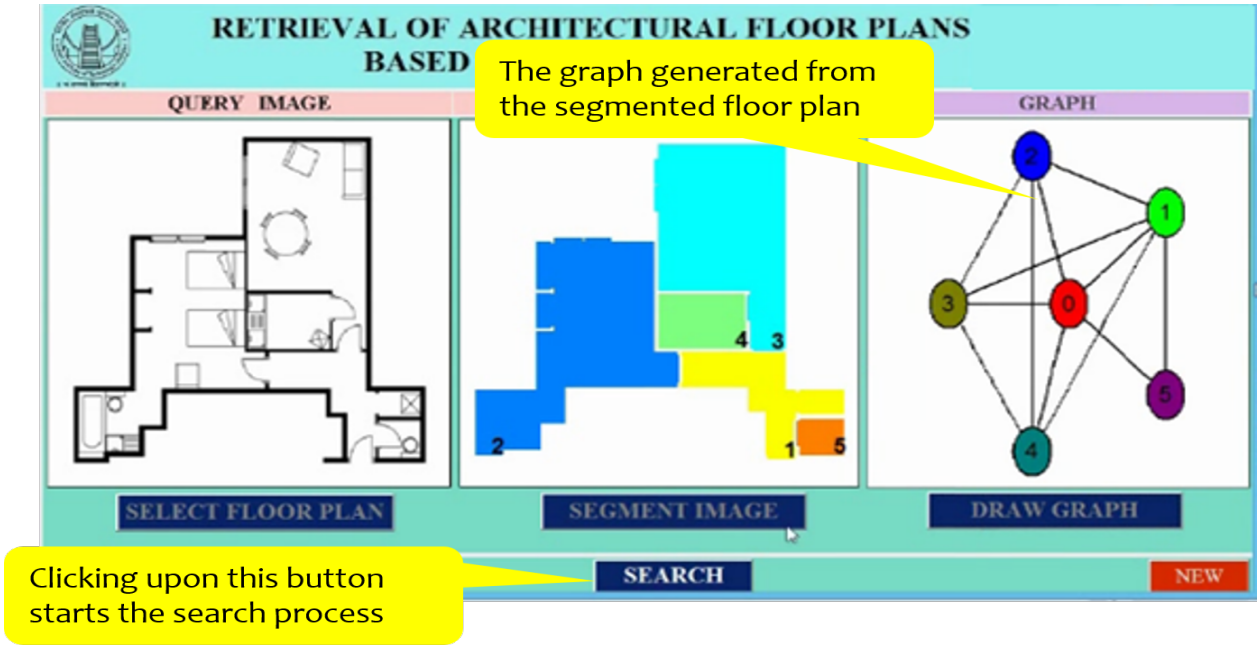

Figure B.5. : Graph embedding of the room level structure of the floor plan.

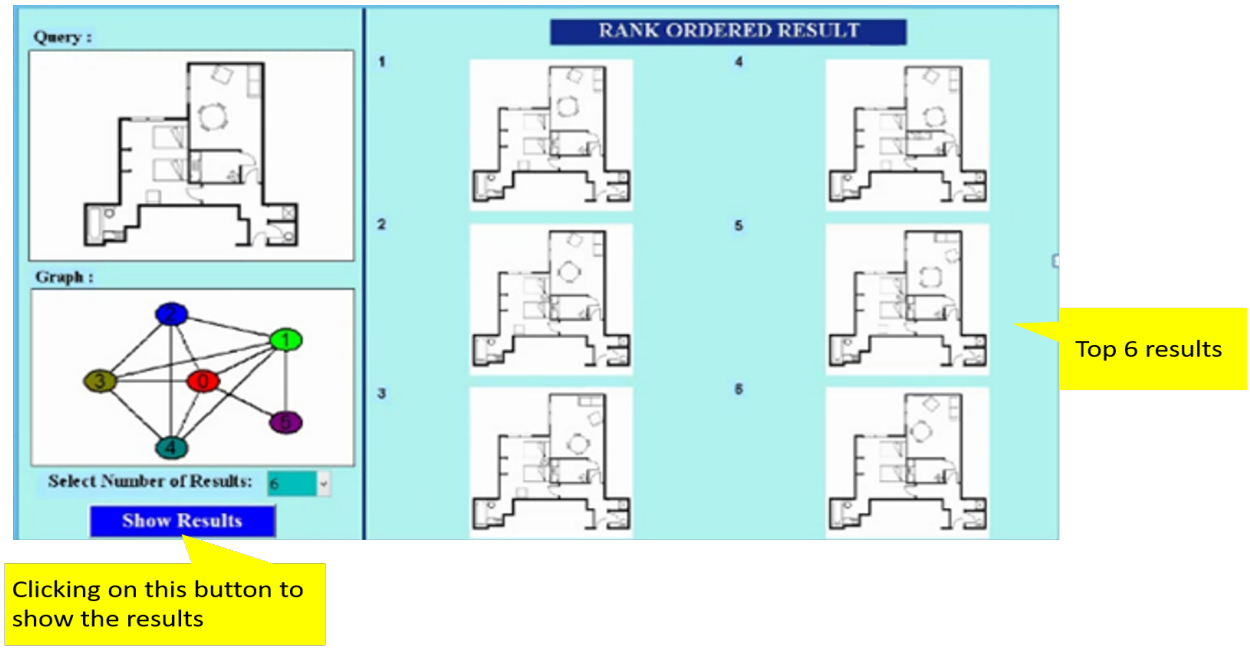

Figure B.6. : Selecting how many results to be displayed while retrieval.

the user has chosen detailed mode, the "Search" button is still disabled as one more step, i.e. the graph creation process is pending.

The next important user experience is shown in Fig. B.5. After the segmented floor plan is obtained with numbered labeling on each room, the next task is to obtain a relationship between these rooms. Therefore, adjacency is used as a parameter to define relationships between them. A graph is created where nodes represent rooms and edges represent which rooms are adjacent to each other. As shown in Fig. B.5, the "Search" button is now activated as the software is ready to do the matching between the query feature and the database features to show the retrieved result.

After the required graph is obtained, spectral analysis of the adjacency matrix is done in the back-end for the query floor plan as well as the database floor plans. The floor plans with similar adjacency are clustered together in the spectral space and thus, the GUI redirects to the second page for retrieval of similar floor plans as shown in Fig. B.6. As shown in Fig. B.6, there are three place holders in the interface. On the left hand side top the query floor plan is shown, while the corresponding graph is shown at the bottom. Just below the graph, there is a drop down list using which the user can choose the value of the number of floor plans to show as result. Upon the selection of number of results to be displayed, the rank ordered retrieval results are displayed as shown in Fig. B.7.

Figure B.7 depicts the final result for top 6 results. As seen in the results the retrieved results are numbered as per their position in the rank ordered list. After the results are displayed, the user can always change the number of results to be displayed. The user needs to choose an appropriate number from the drop-down list and then click the "'Show Results" button. The number of floor plans shown as results are updated accordingly.

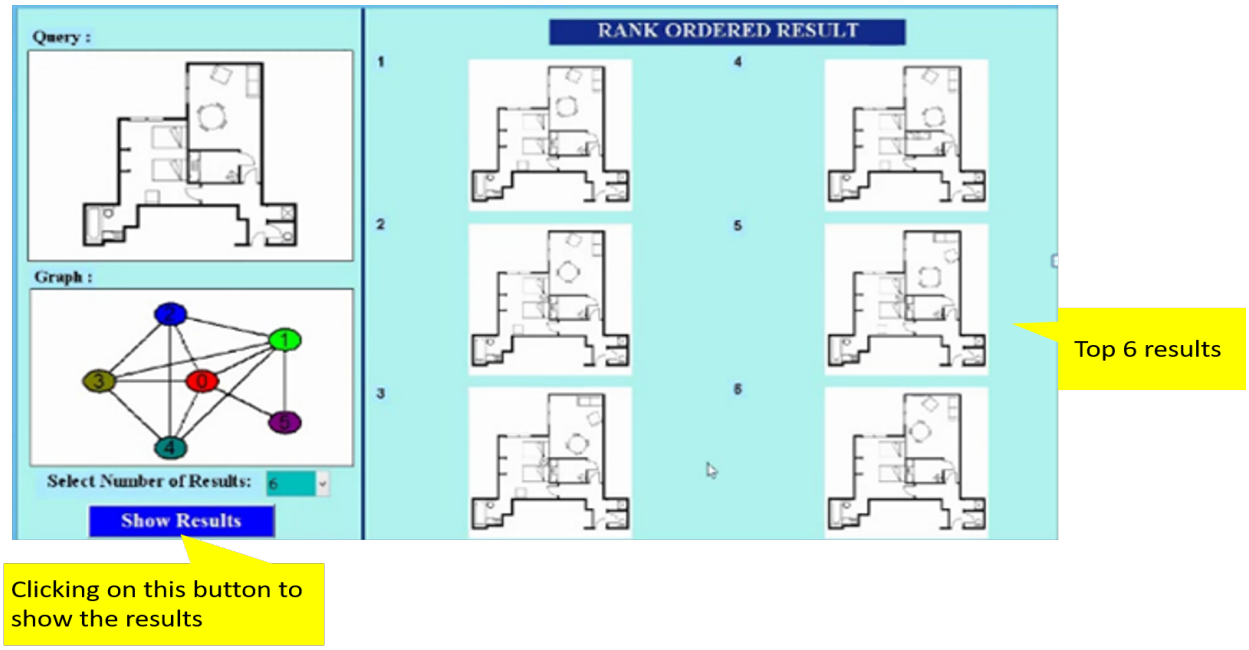

Figure B.7. : User's required floor plans on display as per their similarity from the query floor plan.

B.4 CONCLUSION

This is an initial version of a platform developed for content based floor plan retrieval. At present, the software runs on system with Matlab installed in it or a system that has a Matlab plugin installed. An extension could be to have a mobile version of the same that can be used easily without any specific software prerequisites.