BTS User Interface Technical Report
Colby B. Stevens and David Mayerich

1.Introduction

The Brain Tissue Scanner (BTS) integrates many different sophisticated instruments. The interactions among these and other instruments are complex and must be aligned and executed properly to maintain proper registration in the collected tissue data. The need arises quickly for a user interface to hide many of these complicated details.

2.Goals

The BTS User Interface was designed to accomplish four goals.

2.1. Ease of Use

The BTS is a complex system composed of many unique and custom-designed instruments. The interface must allow the user easy and confident control. This is accomplished by using a graphical event driven interface. The user enters data via the keyboard and moves through the interface by clicking buttons.

This interface minimizes the number of essential inputs. Any parameter that can be calculated from other data that has been previously determined and stored by the interface, does not require user input.

2.2. Optimize Safety

Improper use of the BTS equipment can result in bodily harm. To minimize safety risks, a majority of the BTS is computer controlled via the interface. However, other equipment cannot be computer controlled directly and must be controlled physically by the user. Using visual aides, the interface guides the user through the correct procedures to control such equipment (at the correct time).

2.3. Ensure Security

Only authorized users are allowed to operate the BTS. A user must have both a login and password to the computer running the interface software, and then must have a login and password to start the interface.

Once in the interface system, users may access only their personal experiment data and are restricted to performing tasks within the scope of a user for which they are cleared.

2.4. Minimize Equipment Damage

A majority of the BTS components are one-of-a-kind and custom built for this project. Because of this, damage to the equipment is both costly and time-consuming to repair. The user interface aims to minimize the chance for equipment damage.

2.4.1. Damage Due to Stage Movement

The BTS uses an air bearing stage to move the specimen under the stationary collimator assemble that holds the diamond knife and microscope objective. The exacting design of the collimator and specimen tank combined with the range of motion of the precision stage can easily damage equipment if an improper stage command is given. Damage can occur to the diamond knife, to the collimator assembly, or to the stage itself.

The interface uses three methods to minimize movement damage. First, all stage movements are computer controlled by the interface. No manual stage control is allowed. Second, the interface stores a specimen profile for each specimen that maps the topography of that particular tissue block. Stage movement commands are checked against this profile to ensure that the knife will only section tissue of an acceptable depth and width. Finally, a profile of the specimen tank is stored; as before, the interface checks all stage movement commands against this profile to ensure that the stage does not move in such a way that the walls of the specimen tank or the specimen ring could collide with the collimator assembly or the diamond knife. (*2,3 Not yet implemented)

2.4.2. Stage and Stage Controller Damage

Other damage may occur to the stage or stage controller even if stage movement stays within the specified profile. The stage and the stage controller (U500) may become damaged if the input air pressure is not within a desired range. The interface monitors an air pressure sensor and can shut down the stage if the pressure is not correct. (*Not yet implemented)
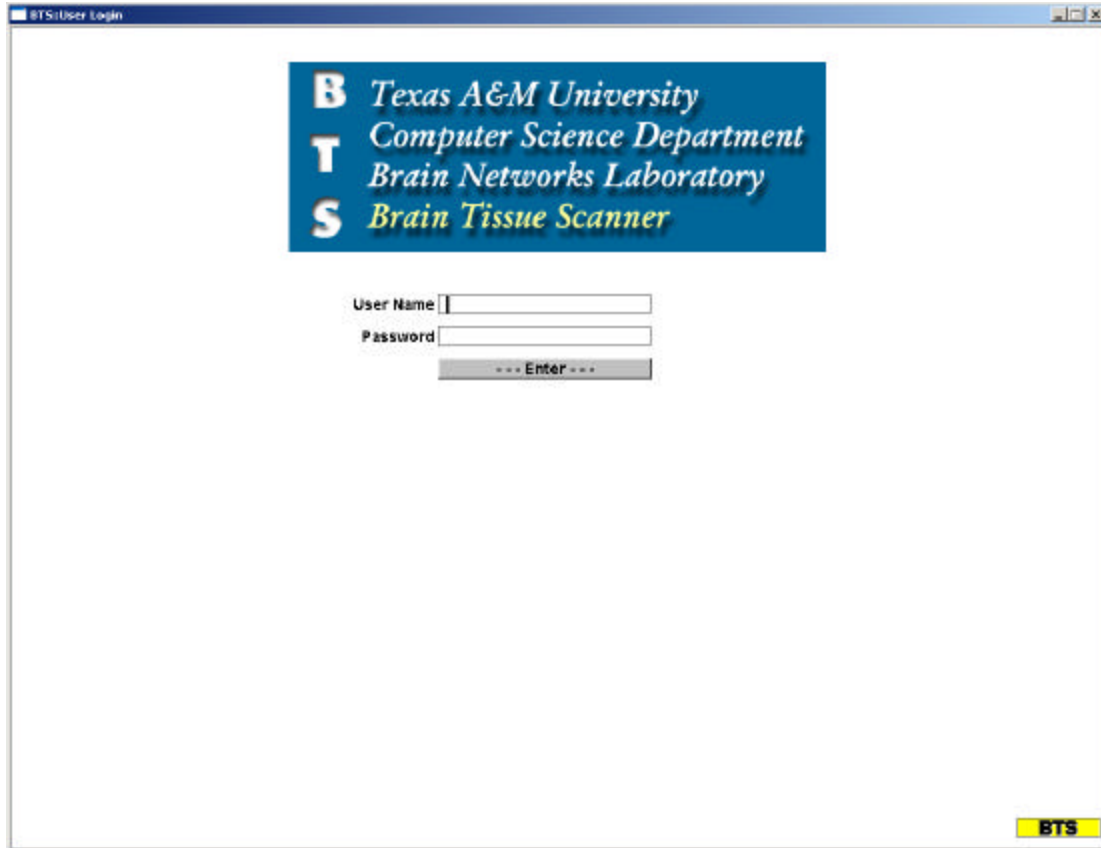
The interface also monitors the audio emissions of the BTS and will shut down the stage if it is emitting sounds outside the norm (such as a loud squealing). (*Not yet implemented)

3.Interface Modules

The BTS interface consists of 5 main modules that are visible to the user.

3.1. Login

This module simply allows the user to enter their user name and password and attempt to login to the interface. See Figure 3.1.

Figure 3.1: Login Module

3.2. Main Menu

After logging in, the user sees a display of the main menu. This module allows the user to start the creation of a new experiment, resume an old experiment, view logs and, in the case of system administrators, to access special software used to align the BTS. See Figure 3.2.
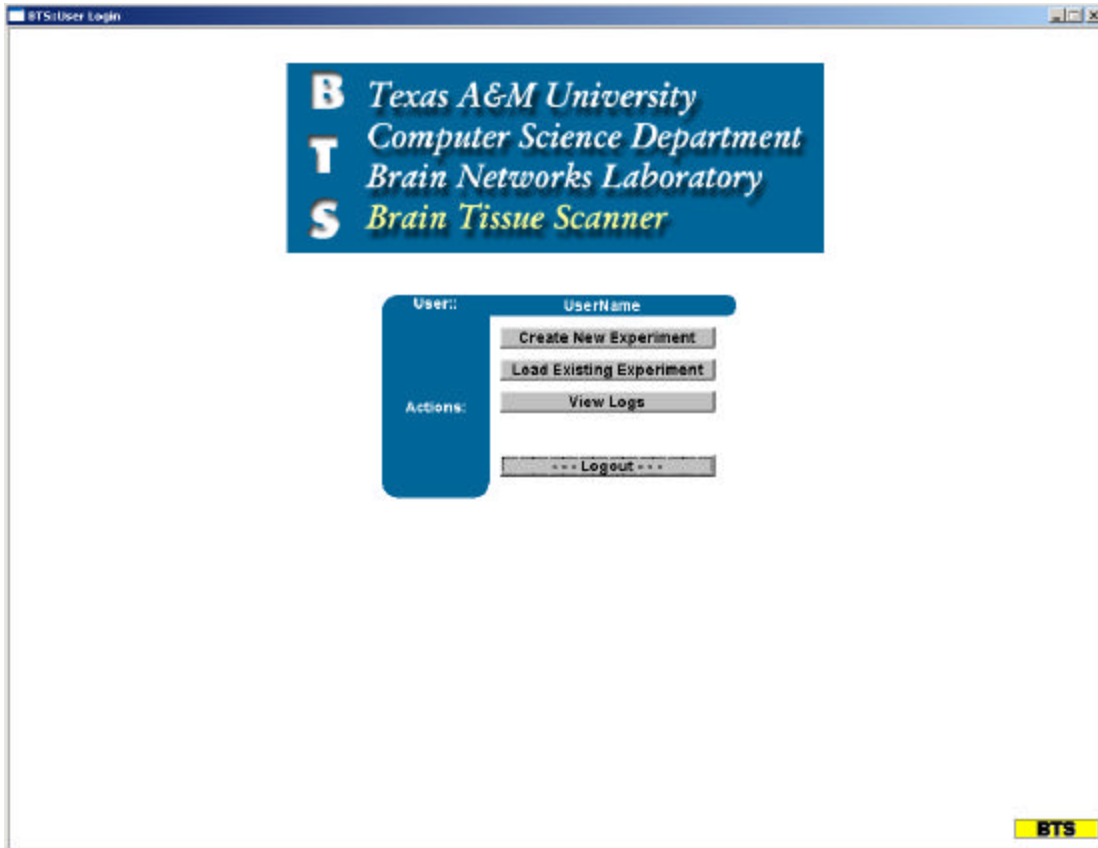

Figure 3.2: Main Menu Module

3.3. Experiment Parameters

This module allows the user to input new experiment parameters or to modify existing experiment parameters before starting the sectioning process. The experiment parameters fall into 5 classes: specimen information, specimen block information, sectioning parameters, camera specification, and laser specification. See Figure 3.3.

BTS:User Login

Specimen Source

Institution: Texas A&M University
Laboratory: BNL
Individual: Colby Stevens
Date Received: 08/14/2002

Specimen Data

Tissue: Mouse
Block ID: 987394
Stain: Golgi

Specimen Mounting

Embedding Material: g36
Mount Type:
- ● Type I
- ○ Type II
- ○ Type III

Block Dimensions (mm)

Length(X): 15
Width(Y): 12
Depth(Z): 9

Tissue Sectioning

- ○ Coronal
- ○ Horizontal
- ● Sagittal

Stair-Step Cutting Strokes (mm)

Section Depth: 0.0005
Sections/Plank: 200
Section Width: 0.625
Max # Planks Deep: 10
Cutting Speed (mm/sec): 6

Optical Specs

Objective:
- ○ 2x (air)
- ○ 4x (air)
- ● 10x (water immersion)
- ○ 40x (water immersion)

Laser:
- ○ 473 nm (blue)
- ○ 488 nm (blue)
- ● 532 nm (green)

Return to Main Menu   Accept   BTS

Figure 3.3 Experiment Parameters Module

3.4. Startup Procedure

The startup procedure module guides the user through the correct procedure to initialize the BTS safely. This is done via text descriptions and images depicting the procedure. The interface also initializes the stage and monitoring software (such as air pressure and acoustic monitoring). See Figure 3.4 (*not yet implemented)

{FIGURE 3.4 HERE}

3.5. Sectioning & Image Capture

The sectioning and image capture module allows the user to start, stop, and monitor the sectioning and image-capture process. The user may pause the process temporarily and later resume the process, or the user may execute an emergency stop if needed. The interface displays a graphical depiction of the sectioning process and displays percentage complete and stage coordinates. See Figure 3.5.
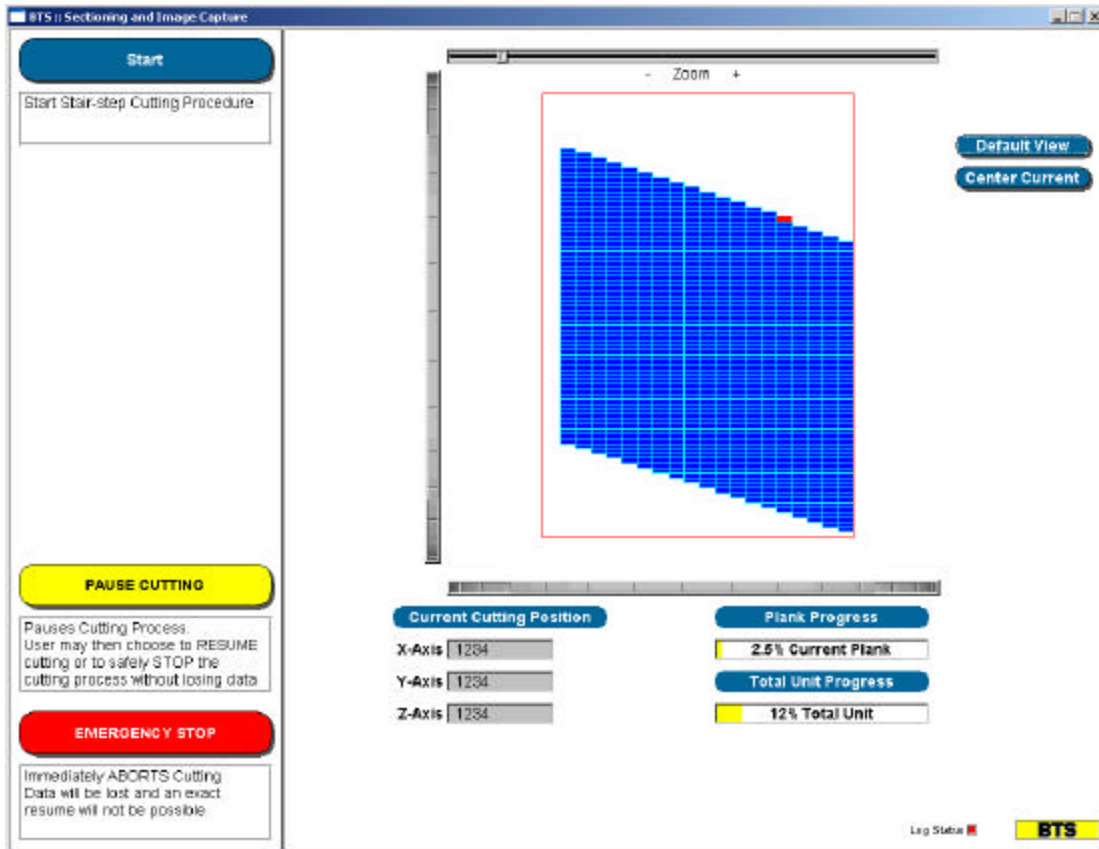

Figure 3.5: Sectioning and Image Capture

4.Flow of Control

The flow of control between the modules is basically linear with only a few loops back to other modules. This is shown in Figure 4.1.
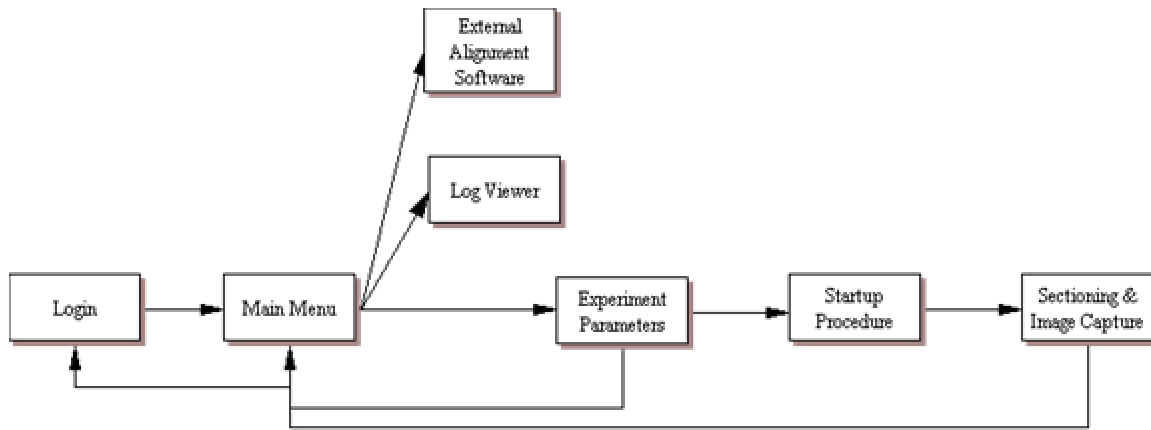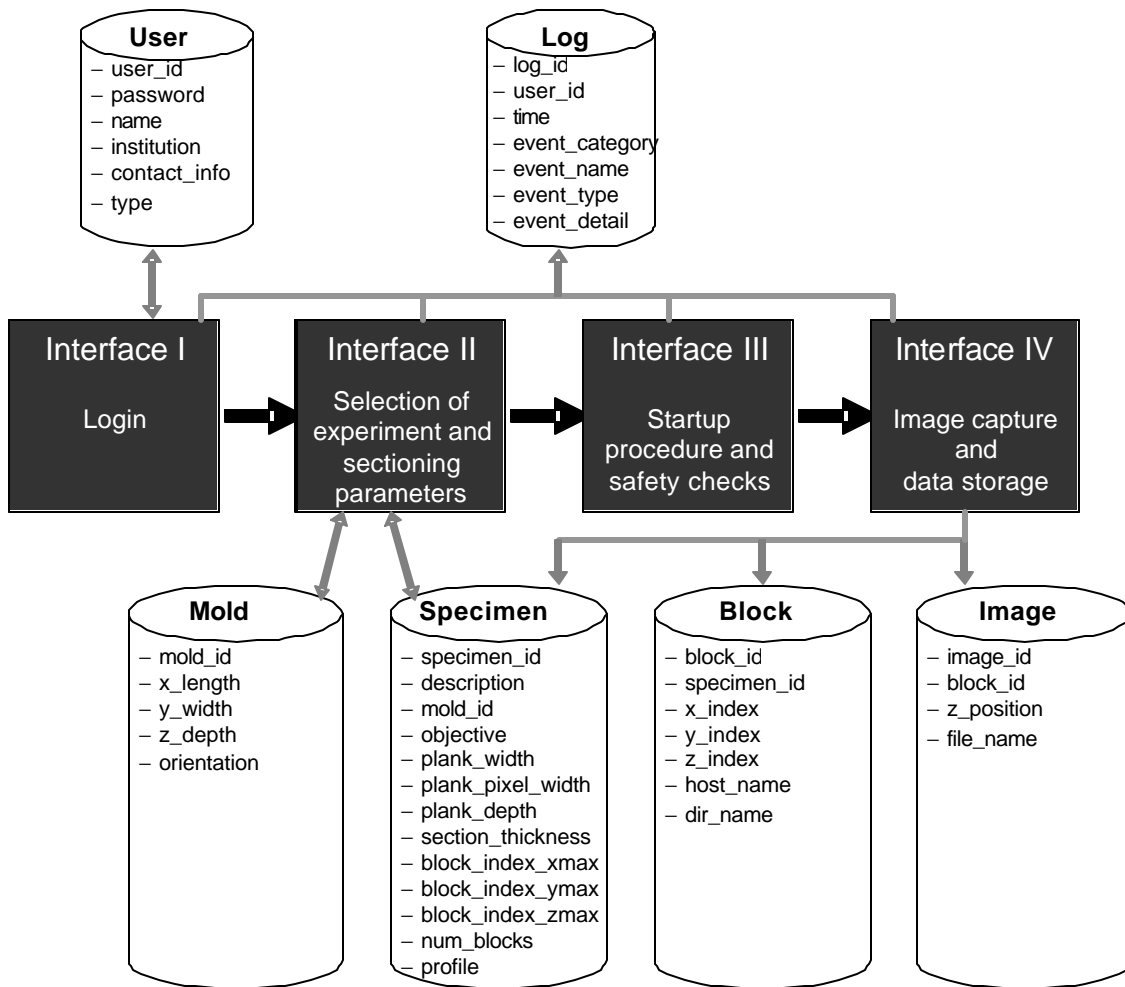

Figure 4.1: Module Flow of Control

5.Module/Database Interaction

User interface modules interact with specific tables in the BTS database. Figure 5.1 shows these interactions. The mold containing the "potted" specimen sites within the specimen tank. (*This figure needs the Main Menu module inserted. The Main

Menu will access the user table, the log table, and the specimen table).

Figure 5.1 Interface Module / Database Interactions (Koh and Stevens).