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# Individual Lab Report - 9

## Autonomous Reaming for Total Hip Replacement

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 **HIPSTER** | **ARTHUR**

Gunjan Sethi

Team C:

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Sundaram Seivur | Gunjan Sethi

November 3 2022

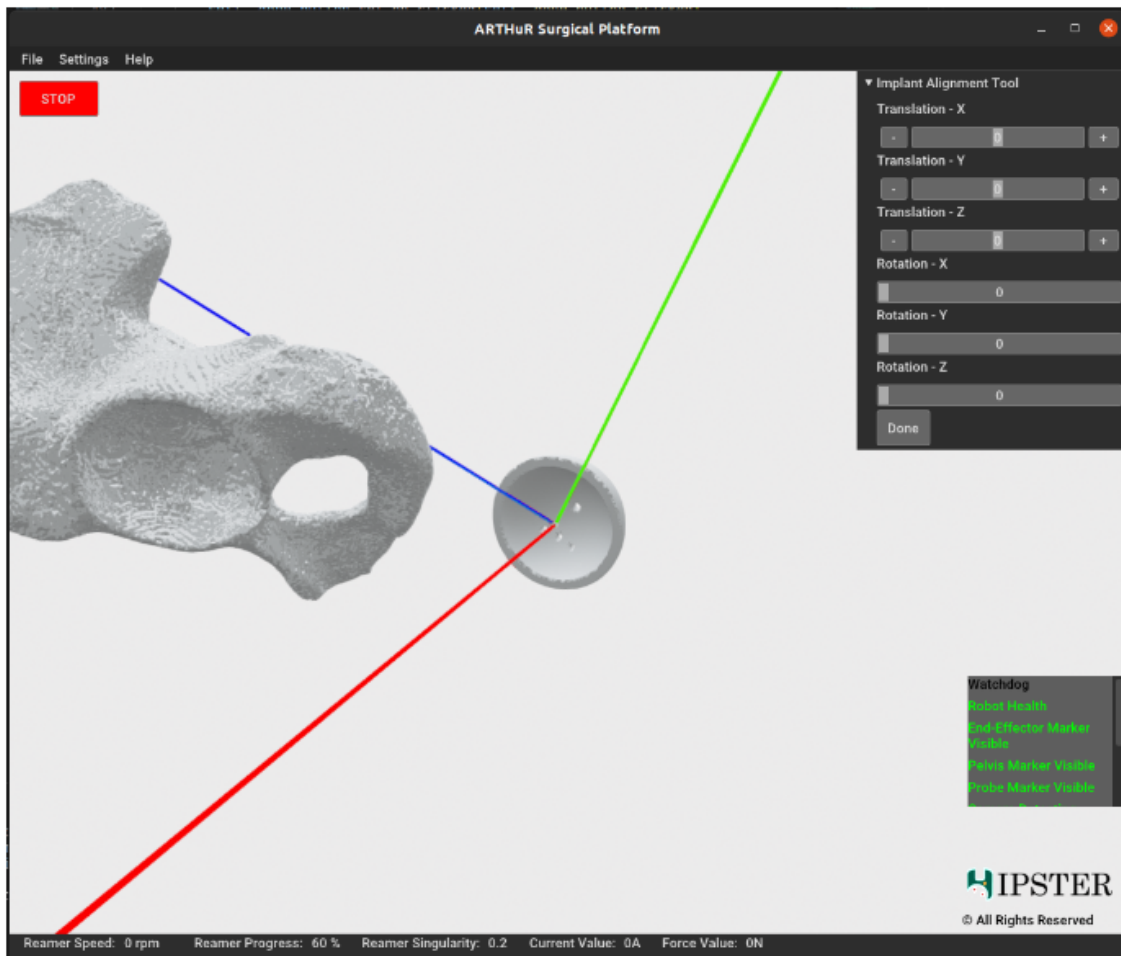
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# 1 Individual Progress

## 1.1 Frontend Improvement

This week I made improvements on the front end. I completed the wireframe as we previously planned. I added the emergency stop button, the toolbox on the right, and the metrics panel at the bottom of the screen. I also added the logo on the bottom right. The updated UI can be seen in Figure 1.

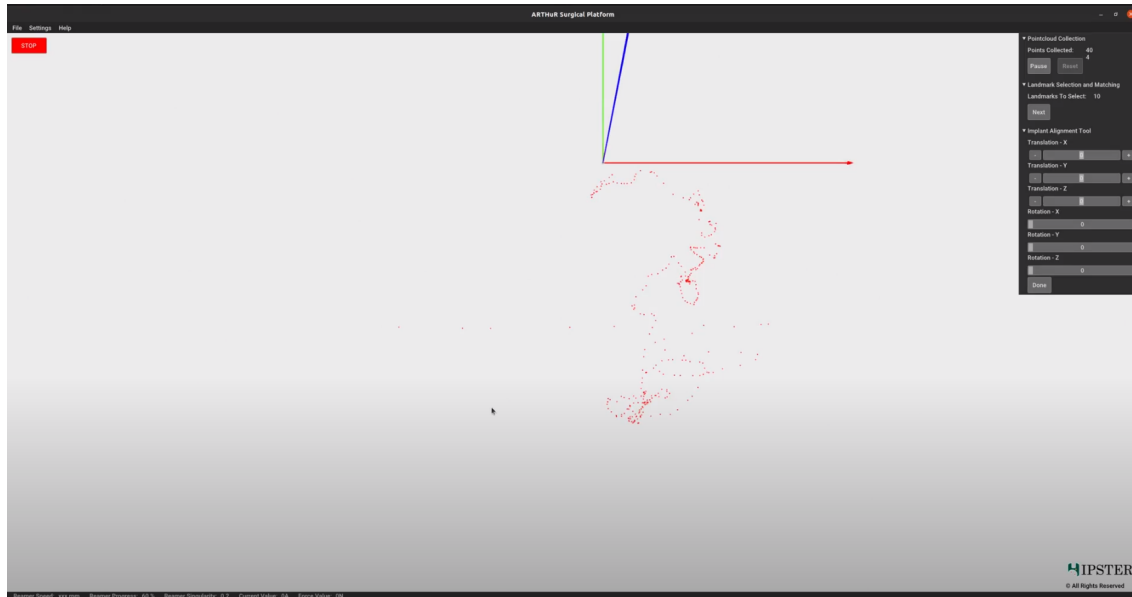


**Figure 1:** Pointcloud Collection

I completed the development of the point cloud collection tool, landmark selection tool, and registration tool. This completes the integration with the perception and sensing subsystem. Currently, these tools are in the debugging stage.

## 1.2 Pointcloud Collector Tool

The pointcloud collector tool is able to render points collected with the registration probe in real time and render them onto the screen. Through the toolbox on the left, the user is able to start, pause or reset the collected points. Figure 2 shows a pointcloud collected on the screen.



**Figure 2:** Pointcloud Collection

### 1.3 Landmark Selection and Registration Tool

The landmark selection tool is able to load the pelvis scan and the pointcloud collected onto the screen. The user is able to interact with the pointcloud and use the mouse to select landmark points. The toolbox on the right can be used to reset the view and move to the next screen for pointcloud collection. Figure 3 shows the pelvis landmarks selected by the user.

## 2 Challenges

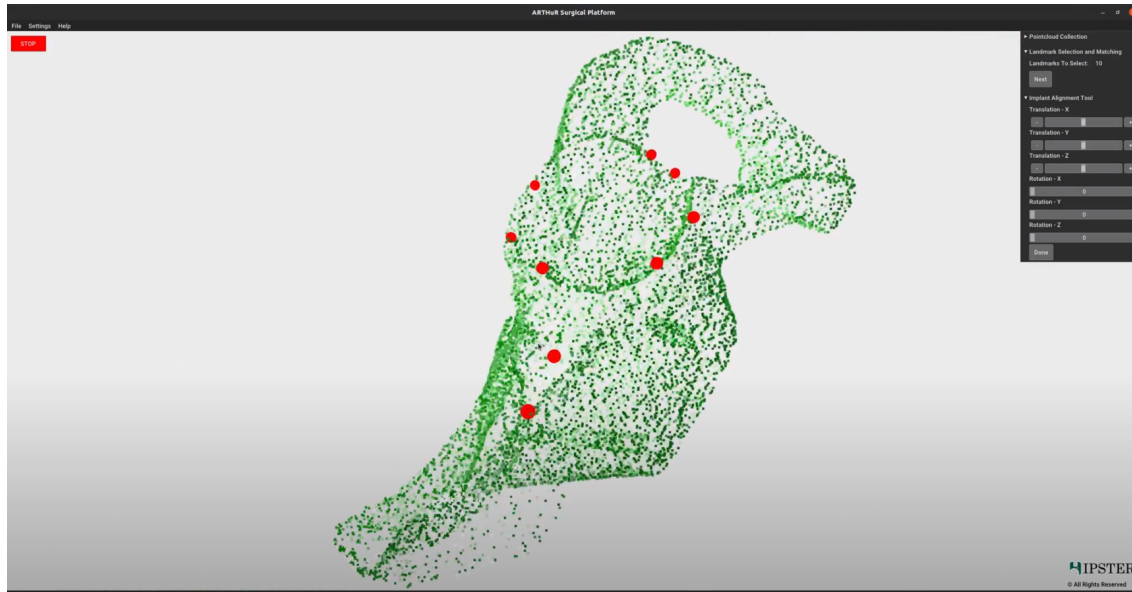
The UI is primarily based on event callbacks. When integrated with ROS, the subscriber callbacks interfere with the UI's callbacks. This causes the UI to sometimes freeze and stop rendering in realtime. To overcome this, it is important to refactor the code. First, this will help in debugging and locating the source of the error. Second, this will ensure all events and callbacks are properly handled.

Due to the amount of time, it takes to debug, sometimes hours, the development of the UI is very slow.

## 3 Team Work

Following are the tasks accomplished by the team members since the previous ILR.

- ***Kaushik Balasundar*** assisted me with integrating the pointcloud collection and landmark selection pipeline with the UI. He also worked with Parker to interface and calibrate the current sensor. Finally, he worked with Parker and Anthony to set up the general framework for end-effector controls.
- ***Parker Hill*** worked on integrating the watchdog and end-effector controls with the UI. Further, he set up the ATO load cells with Anthony and also integrated the current sensor into the



**Figure 3:** Landmark Selection

electrical subsystem. Finally, he ordered manufactured parts and finalized the end-effector design along with Anthony and Sundaram.

- **Anthony Kyu** worked with Parker and Sundaram to finalize the end-effector design and implemented collision detection in the controls subsystem. He also tested controls on the real arm and integrated it with the watchdog.
- **Sundaram Seivur** worked on further developing the watchdog. He also worked with Anthony to integrate controls and the watchdog.
- **Gunjan Sethi** worked on the UI. She integrated, tested, and debugged integration with the perception subsystem.

## 4 Plans

For future work, the following (individual) tasks have been planned for the MRSD project.

### 4.1 Complete Implant Alignment Tool

The main task for the upcoming PR is to complete the implant alignment tool. This will decouple the UI from new development and we will be able to test our pipeline end-to-end. As the team continues to test the pipeline, I can continue to improve the UI.

### 4.2 Integrate with Controls and Test

Since the controls subsystem is still in progress, the integration with controls is a big upcoming task. Once completed, we will be able to visualize all metrics and controls data on the UI.

### **4.3 Debug, Debug, Debug**

As mentioned in the challenges section, lots of small bugs exist in the UI. I will continue to debug those. We are now maintaining an Issues Log to track all the bugs.