

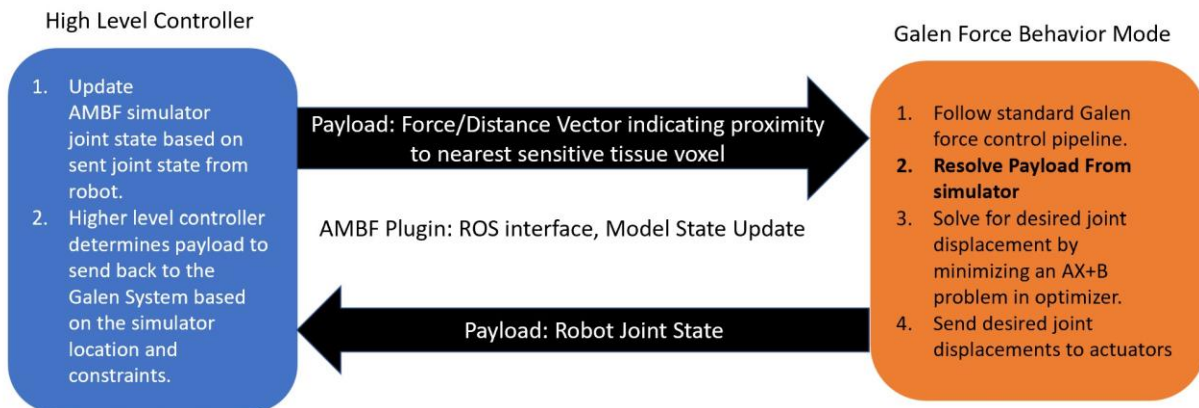
# System Architecture

## Project

### Project Overview

“VR-Guided Skull Base Surgery” is focused on Mastoidectomy which is a surgical procedure that requires the surgeon to drill out a portion of the patient’s skull to reach the inner ear. This surgery is often assisted by “steady-hand” surgical robots. These robot systems, however, have little to no awareness of the context of the surgical state, hence, can only provide limited feedback to the surgeon. An ideal accommodation for this challenging procedure is to provide the robot system with the ability of situation context-awareness so that the robot system can provide higher-level constraints to protect the patient. To achieve “situation context-awareness,” we invoked a combination of the actual robot state and the robot state in a simulator (AMBF, Asynchronous Multi-Body Framework). The real-time surgical situation, including the patient’s pose and the robot’s status will be reconstructed in the simulator. The simulator, on the other hand, will analyze the current context, and send critical information back to the robot controller to enforce safety constraints.

### Architecture Overview



## AMBF Simulation

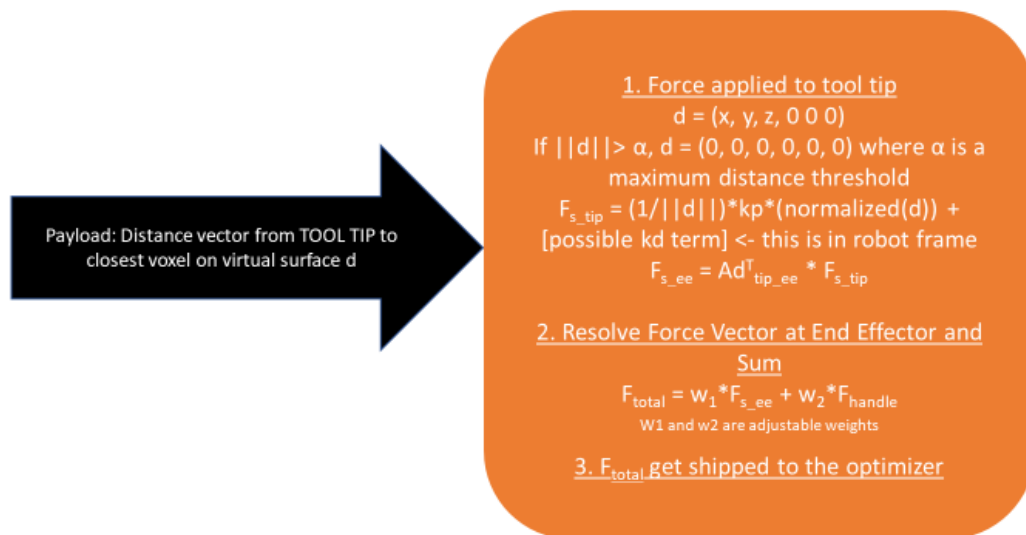
Simulator Overview

Galen Plugins

Meshes Used

Distance Calculation (will be replaced with SDF Gradient Approach)

## Galen-Side Controls



The steps for calculating the additional force term from the simulator are shown above. Note that while the distance vector is calculated from a simple distance from a virtual surface, this vector can be directly replaced with a gradient term determined from an SDF calculation.

## User Guide

### Running the system

1. Start Robot (“runrems in terminal for current iteration”)
2. Click “Drill” to load drill settings, and put robot in “ftVelocityMode”
3. Click “ftVelocityModeSim”
4. Launch Simulator:
  - a. In terminal:
  - b. Go to ambf/bin/linux86 folder
  - c. `./ambf_simulator --launch_file <launch file .yaml location> -l 4,5`

### Source Location

<researchrepo and sim repository, more info later>