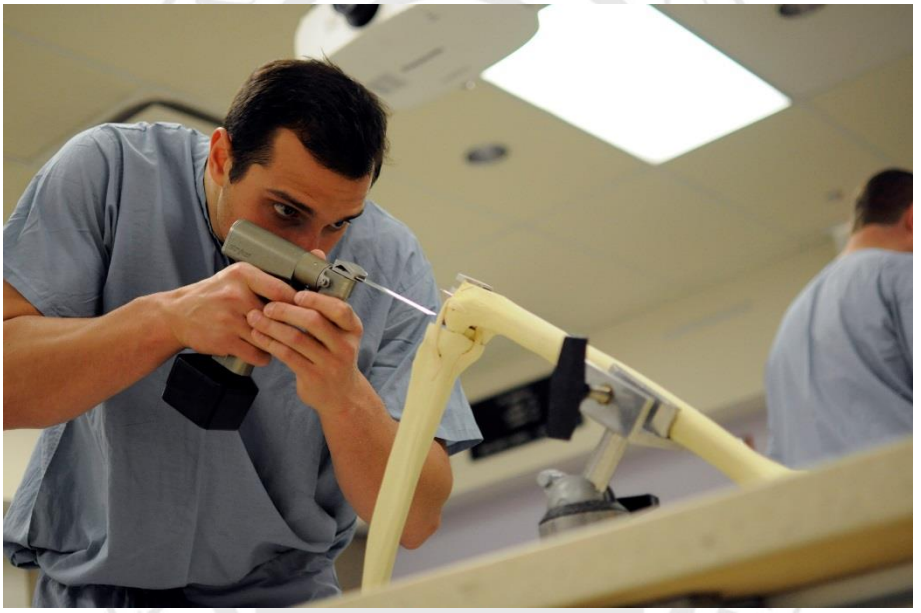
TECHNOVANZA

Taking technology to society

Stryker Technical Challenge

#Challenge 1

Mechanical Challenge



Virtual Surgery Contest

Introduction:

Do you know what it takes for a surgeon to perform a Total Knee Replacement (TKR) Surgery?

Do you know how medical devices help surgeon to perform replacement surgery? If not, this event is for you. This event will give you all engineering insights behind a replacement surgery.

You will witness the surgical steps, electro mechanical instruments & surgical instruments that helps surgeon in performing their duties and make patient`s life comfortable again. The efforts it takes to restore a patient's biomechanics and let him return back to normal life is definitely exciting.

Problem Statement:

- Form a cross functional team (Size-4) which should have representation from at least 3 different engineering streams.
- Understand Femoral Preparation procedure (part of TKR) which requires electro mechanical instruments and surgical instruments. You can refer following links from live surgery videos: https://www.youtube.com/watch?v=mfqObHXeJpw&t=14s
- On the event day, you will be given all the required saw bones (Dummy representation of bone), jigs and instruments. Based on your learning from surgical protocol (https://www.strykermeded.com/media/1165/triathlon-surgical-protocol.pdf), you need to identify all the components required to do femoral preparation (*steps from page 4 to 15 of surgical protocol*).
- Your team need to prepare one femur (on saw bone) with the help of surgical instruments given to the team. You will be given a specified size of Knee Femoral Implant which should fit precisely into the prepared femur sawbone.
- The winning team will be decided based on following various parameters:
  1. Time taken by the team for femur preparation (maximum of 30 minutes)
  2. Quality of bone cuts (precision, flatness) and amount of sawbone removed for femur preparation.
  3. Fitment of implant on femur on prepared bone.
  4. Accuracy of surgical steps followed from Surgical Protocol (*the team won't have access to surgical protocol during the contest).*

#Challenge 2

Software Challenge

Background:

In robotic medical surgery, tracker mounted probes are used to mark the location of points on bone. Optical trackers are ones that can be detected by camera. The camera also needs to identify trackers of different kinds. For example, a sharp probe might be used to dig through the cartilage and hit the bone and a blunt probe might be used to collect points over the cartilage.

Problem Statement:

Distinguish between the trackers on the blunt probe and the sharp probe.

Input:

You would be given 10 images each of both the trackers.

Test:

Your algorithm will be tested against 10 images each (different from those that are given to you for training) of both the trackers. For each correct classification you would get +1, and for each wrong answer you would get -1. Thus, the total score would range from -20 to +20.

Presentation:

The teams have to prepare a 5 minute presentation of their algorithm.

Deliverables:

An executable that reads all images in a folder one by one, implements your algorithm and prints a vector of zeros and ones, “0” for each detection of blunt probe and “1” for each detection of sharp probe.

Eg. 0 1 1 1 0 0 1 0 …… 1 0

Tie Breakers:

1. Algorithm Quality
    a. Time complexity
    b. Space complexity
2. Code Quality
    a. Design/Modularity
    b. Comments
3. Stability
    a. Should not crash when given wrong inputs
    b. Should not crash when given wide range of correct inputs.

Suggested Algorithm Steps

1. Try to binarize the image using an adaptive threshold so that the elements of the tracker are white and the background is black.
2. Try to automatically find the centers of the detected foreground regions and look at the ratio of the distances between them.

Suggested coding choice

1. OpenCV or other open source image processing libraries
2. C++/Java/Python

Pre-requisite for participation

Each team is expected to have their computer to implement their algorithms.

**Technical Quiz may be conducted on the spot in order to shortlist the teams.