OPTIX: Optical Position Tracking for Interoperative X-Rays

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The Problem
Orthopedic surgeons in all countries get most of their radiation exposure from having to perform a time-consuming iterative process that involves taking several (usually 7) X-ray shots to help determine where the C-arm should be placed. Orthopedic surgeons do this process their entire career, but long-term exposure can increase the likelihood to develop cancer, cataracts, and other disorders. These extra X-ray images have no other use other than to guide the C-arm to the desired location. Thus, around 87.5% of the radiation could be avoided, and a lot of time can be saved if these X-ray shots were no longer necessary move the C-arm to key positions [1].

Our Solution
Main components of our solution:
1. A user interface (app) to support the use of our system during surgery
2. Hardware: two cameras, a processor, a mount, a monitor, lighting and Bluetooth
3. Implementation of computer vision and algorithms to track position

Our solution uses two cameras to capture optical floor data instead of one to improve robustness and to increase accuracy. Lighting is important to ensure the optical data from the cameras are of high quality. The optical data is then processed through the processor using computer vision and algorithms that is fast and accurate to track key positions. An intuitive app on the monitor will allow the surgeon to operate our device during surgery to either save the current location or return to a saved location. Bluetooth is used to communicate between the processor and app to prevent external cables from obstructing procedures. During surgery, the surgeon can save key locations and return to these key locations through our solution.

Future Work
• Make the UI more visually appealing
• Filter the images more to reduce mismatches in features in the images
• Improve camera mount to allow use in more different C-arm designs

Conclusion
In conclusion, this device reduces doses of radiation that patients and medical professionals must endure while simultaneously improving the efficiency of medical procedures. If this device is installed on C-arms throughout the industry, it would be able to provide reduced harm and increased productivity. As more and more countries increase their standard of medical care each year, more surgical procedures are preformed indicating that this device has a strong and growing market to expand into. Surgeons, radiation technologists, and patients all have benefits to look forward to by adopting this revolutionary device.

Reference / Bibliography

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