Da Vinci Research Kit: A tool for Surgical Robotics and Human Factors studies

PURDUE UNIVERSITY
College of Engineering

BACKGROUND

Robotic Assisted Surgery (RAS) has revolutionized healthcare field breaking the gaps between technology and surgery procedures. **Robotic Minimally Invasive Surgery (RMIS)** are techniques involving smaller incisions compared to traditional surgery methods, it benefits both patient and clinicians from an ergonomic perspective. For example, surgical robots help to minimize recovery time, cause less pain ***in patients***. Also, it helps to improve control, dexterity, and greater visualization ***for surgeons*** [1].

Figure 1. Surgical application performed with Da Vinci Clinical robot up to 2019. source: arXiv:2104.09869**[cs.RO]**

RESEARCH QUESTIONS

- How Robotic Assistive Surgery can improve patient outcomes?
- How to address human-factors issues that can lead to human error during robotic assisted procedures?

SIGNIFICANCE

- A systematic review revealed that robot techniques performed better than the laparoscopic techniques with ***-5.57, -11.25*** in mean differences for ***overall workload and heart rate***, respectively [3].
- In the existing literature can be found investigations related to study how Surgical Assistance Robots can ***improve surgeon capabilities***, but at the same time it might cause ***difficulty on teamwork coordination*** increasing cognitive workload [4].

GENERAL OVERVIEW DVRK

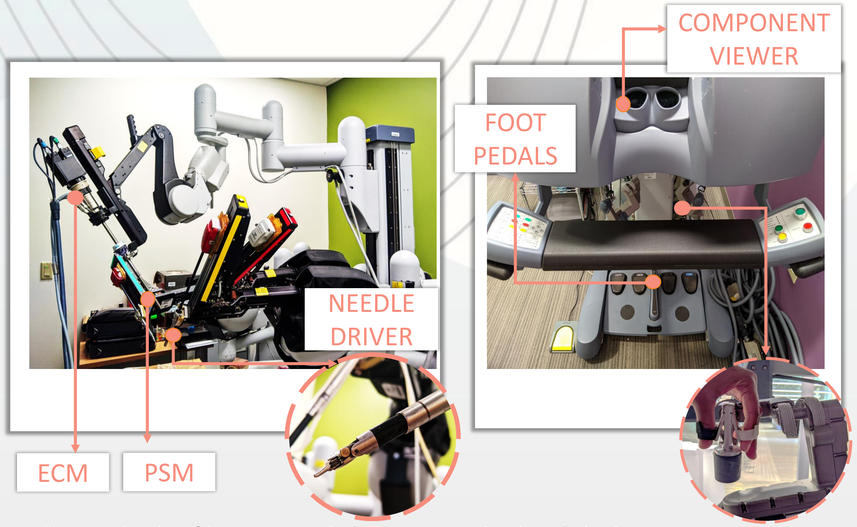

Figure 2. (Left) Patient Side system & (Right) Surgeon Console to teleoperate the robot, located at Purdue facilities.

INTERFACE AND FEATURES

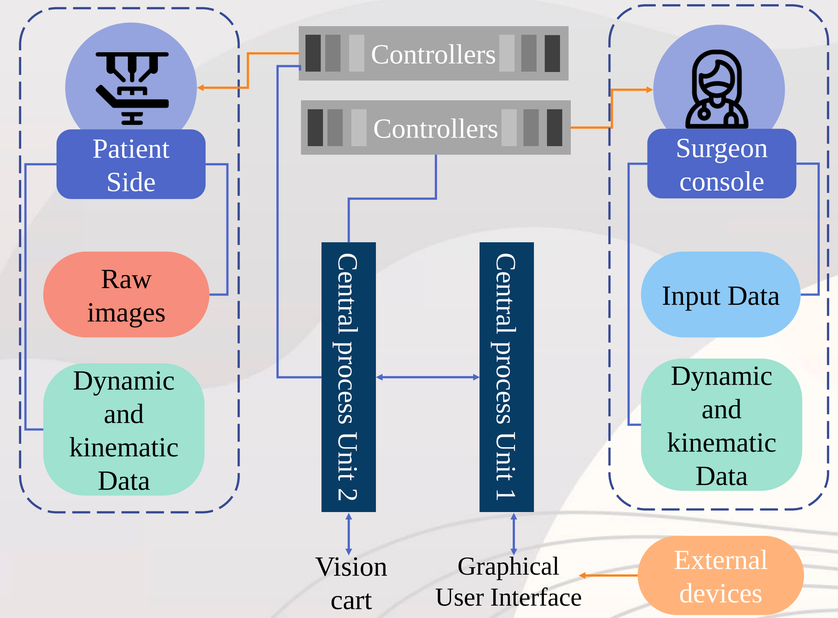

Figure 3. Interaction between components from the general system and data obtained as a result from teleoperation of the robot.

DISCUSSION

Although RAS improve the surgeon's performance, it is still not well understood what medical errors are caused by human factors and instrument failures. From out laboratory, we have addressed this issue from an ergonomic perspective using the dvrk and other sensing devices as EEG, Eye- tracker that measures physiological signals, and other qualitative tools to assess cognitive load. It will allow us to obtain real-time feedback from surgeons and see how they can improve they performance.

CONCLUSION-IMPLICATIONS

The dvrk is one of the most used platforms to do research in robotic assisted surgery. This has helped professionals to perform better surgical procedures. On the other hand, design an experiment which can simulates the complex environment of the surgeon theater is a big challenge for investigators because there are the different parameters involved in surgeries as noise, teamwork, task difficulty and experience and that makes it hard to create an atmosphere similar to the operating room (OR) from a laboratory.

ACKNOWLEDGMENTS

Special thanks to my advisor Dr. Yu D., and my mentors: Yang, J. PhD student & Barragan J. Antonio Master. UREP-C program and Universidad Nacional de Colombia Medellín.

REFERENCES