Career Readiness Challenge

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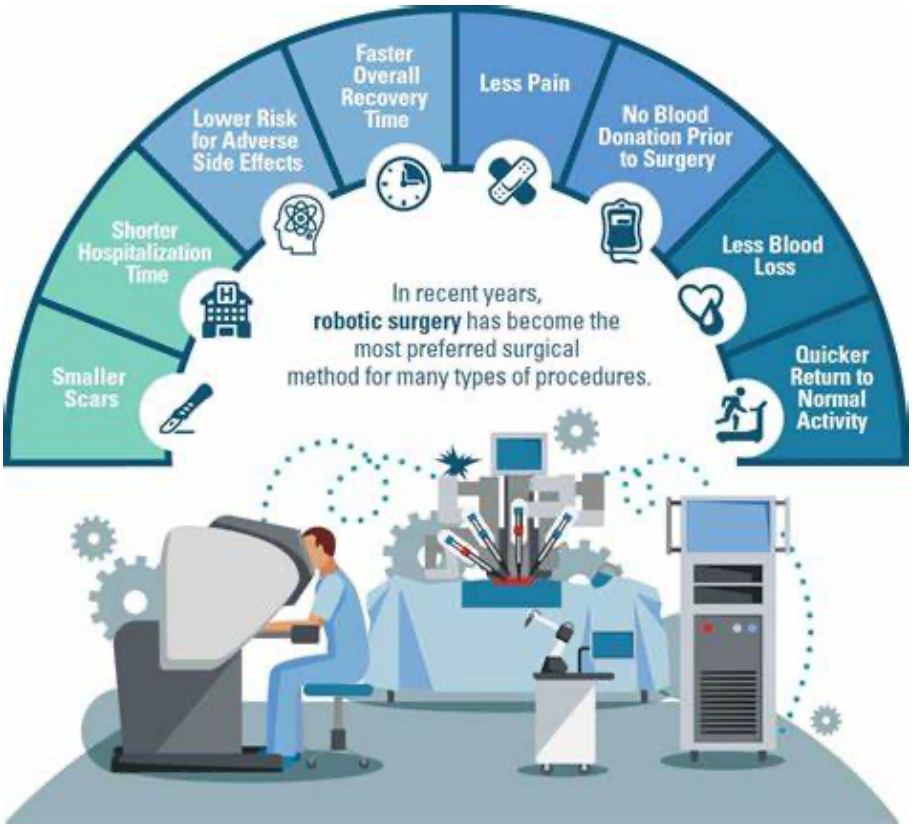
Have you ever watched a robot perform complex surgical procedures and save lives? It is fascinating. Robotic surgery has several benefits and is the most preferred surgical method.

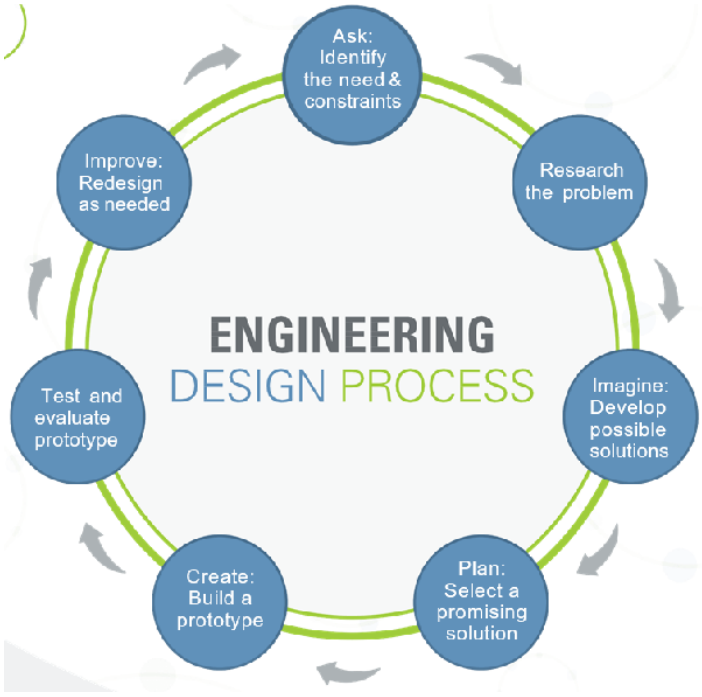


My dream is to become a robotic surgery engineer and work for a company like Intuitive Surgical, Inc. They develop advanced robots that not only perform surgeries, but also train surgeons. By combining engineering, clinical research, and artificial intelligence, ISRG's robots can collect patient data to predict recovery and even perform tasks that humans can't do like performing brain surgery in a minute.

Engineering Design Process Steps:

Intuitive Surgical, Inc. follows a systematic process to design and build robots for various tasks, similar to the VEX robotics program. The process consists of seven steps:

- **Ask:** The engineers **identify** the problem they need to solve by asking critical questions to the doctor. This way ISRG can solve critical problems that meet the doctors need. For example, they may need to design a robot that can detect cancer cells.
- **Research**: The engineers **research** possible solutions to the problem. They may consult with people in different scenarios, look for existing solutions that can be modified, or seek advice from other experts.
- **Imagine**: They **brainstorm** the solution that would best meet the current requirements.
- **Plan:** The engineers **evaluate** their ideas and check if they meet the criteria, such as the robot's interaction with the patients, or the robot's functionality. IRSG starts off with more than one idea. This is because design is better when it is a collaboration of several perspectives. The last steps of planning are combining and selecting the best design option.
- **Prototype:** The ISRG's engineers then **prototype** the final design idea of their robot or a part of it. They use various tools and materials to create a working model of their idea.
- **Test:** The engineers then t**est** their prototype and observe its performance. They take notes on the prototype's strengths and weaknesses, and decide what aspects need to be improved or kept.
- **Improve:** The engineers **refine** their design and draw their final version. They improve the robot based on the feedback from the testing phase. If it works, they send it to the hospitals. If it isn't quite there yet, it cycles between the testing and improving phases.



Although, that comes back to the question. How is this related to my team's steps in VEX?

- **Ask:** Our team begins by trying to solve a problem. The requirements are the rules for the competition published by VEX. We also try to improve our robot by coming up with goals that it can achieve. For example, solving the problem of phasing into the supply zone. This is like how ISRG asks doctors for problems.
- **Research**: After identifying the problem, we researched ways to solve the problem and strategies that will help get maximum points. As we discussed and debated, we found innovative ideas. Like Instructive Surgical, Inc. gets ideas from specialists, we also drew inspiration from internet and other robots to come up with a design.
- **Imagine**: We listed the basic components like intake, outtake, lift that the robot would need.
- **Plan:** We plan to build the robot in multiple iterations with a specific capability added to the robot for each iteration.
- **Prototype:** That is when our excitement ramps up. Building time! We prototype multiple ideas and see what best works.
- **Test:** We drive robot around and find what we have to improve on. This is how Instructive Surgical Inc. finds issues with what they built.
- **Improve:** That comes to the final step where we plan for the next goal that the robot has to accomplish.

Learnings from VEX:

1. **Iterative development**
   We built our robot in Crawl-> Walk-> Run phases. Instead of developing the most complex robot from start, we do in multiple iterations. This helps us test and verify our design before we add more capabilities to it. Also we had a robot ready to go for the first few competitions.

   Crawl Phase: We first started off with a simple robot that could intake only green cubes and dump them, as well as knock down the red blocks.

   Walk Phase: We were able to intake both, green and purple blocks, and sort them into different section on the lift to dump them. However, we had to dump purple before we dumped green. Along with, hitting the red block of their stands.

   Run: Finally, the intake was made faster when intaking the green and purple blocks and the lift was able to sort the different sized cubes. Also, this time we were able to dump any color any time we wanted.

2. **Divide and Conquer**
   We had builders, coders and journalists in our team, and everyone chose the roles based on their strengths. We had to coordinate between the different people, so that we can share the robot and make progress on the autonomous as well as manual run.

3. **Communication & testing components**
   We learnt how important it is for us to communicate with each other. We built lift but realized that it did not fit into the robot when put it in. We also learnt to test components separately like drivetrain for friction and alignment before building the whole robot and then finding out problems with the robot.

All these skills are used by Robotic Surgical Engineers. I am glad VEX has taught me life lessons and prepared me to accomplish my dreams.

Work Cited

Robotic Surgery: History, Advantages, Disadvantages and Applications (healthcarebusinessclub.com)

Intuitive | Maker of Da Vinci & Ion Robotic Systems

https://www.quora.com/What-are-the-8-steps-of-the-engineering-design-process