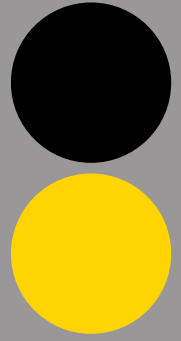




PULSAR - 20785D, UNITED KINGDOM

CAREER READINESS CHALLENGE

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Our Chosen Career Is:

PRODUCTION OF SURGICAL ROBOTS



Why Surgical Robots?

One of the many purposes of engineering in today's world is to improve people's lives and standard of living. When we came across multiple articles about the advancements of surgical robots and their impact on the field of medicine, we realised how important this technology was to save many people's lives. Therefore, we thought that it was important to research on the design process of these robots as they have to be extremely consistent and accurate, which are key skills also needed in our robots in VEX. Therefore, we as a team also believed that we can learn from this design process. Surgical robots automate and accurately perform small incisions in order to help doctors cure diseases such as heart diseases more quickly and safely.

The Design Process of Surgical Robots At CMR Surgical®.

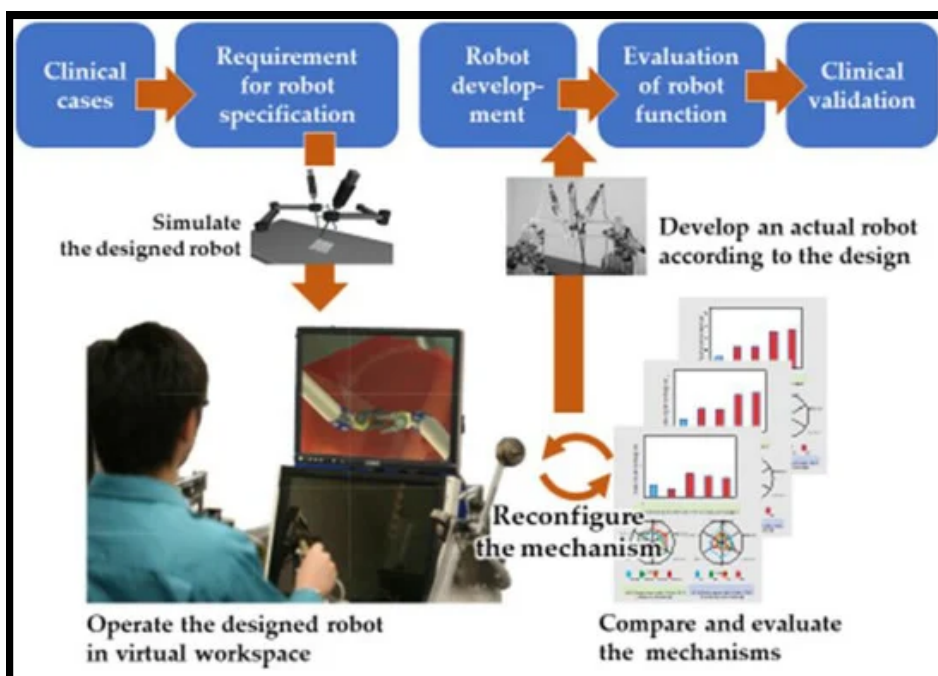
Below is a link to the CMR Surgical website:

<https://cmrsurgical.com/versius>

Before we look at the intricate design process used at CMR Surgical, we first need to focus on what the key features are of a surgical robot. After thorough research, our team found 3 key principles to achieving a good surgical robot:

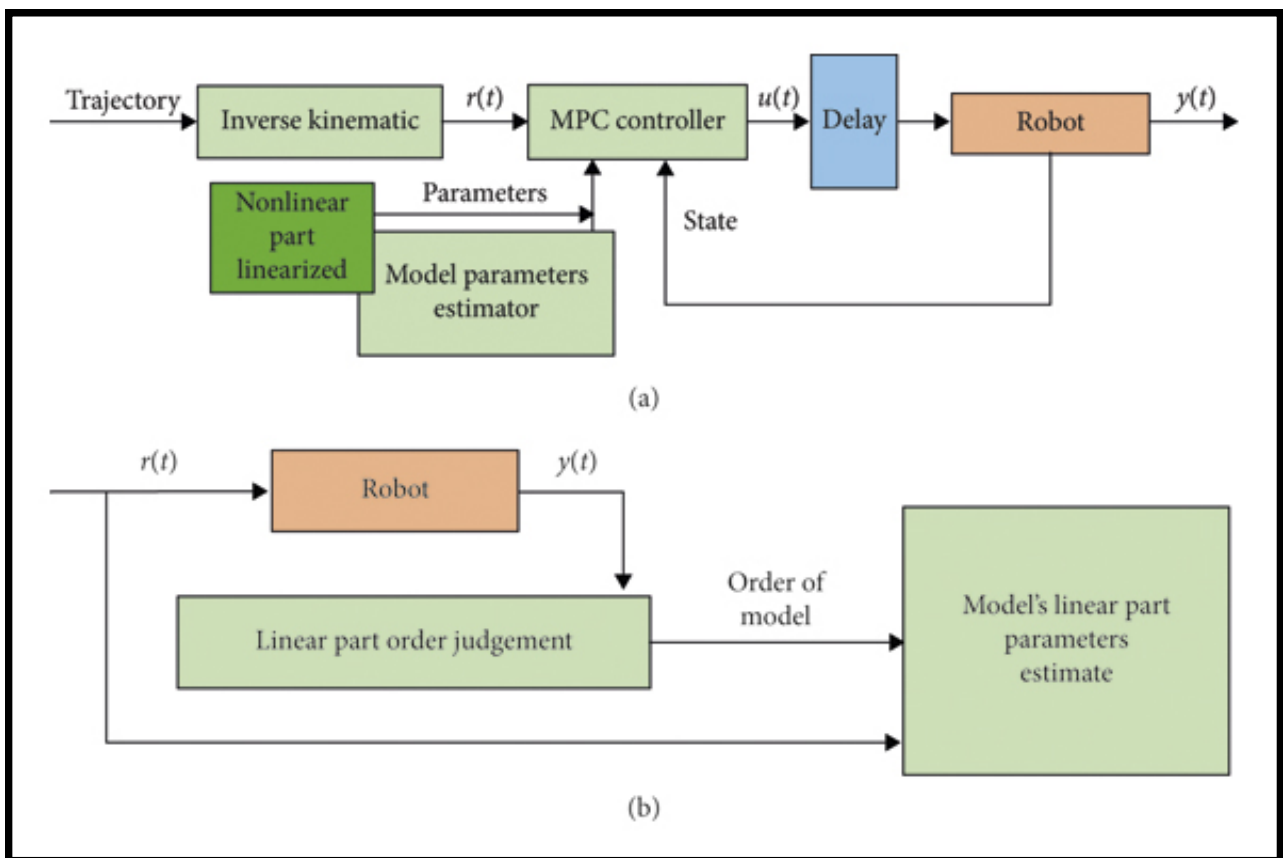
1. Surgical robots must be able to communicate information clearly with all doctors/surgeons in order to reduce any chance of miscommunication, leading to errors.
2. Surgical robots must be able to conduct processes accurately and efficiently.
3. Surgical robots must be able to be ergonomically beneficial and help the surgeons be comfortable using the machine

CMR Surgical achieves these goals by using the iterative design process shown below:



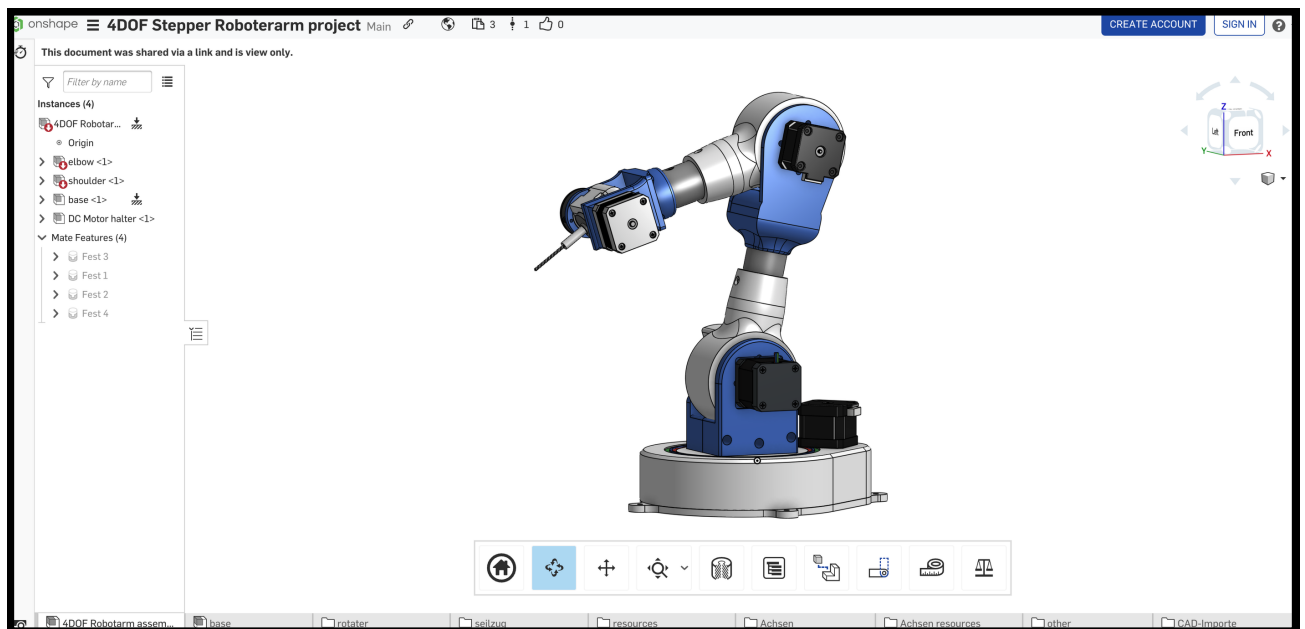
In the first stage of this design process, CMR Surgical identify the problem faced by surgeons by looking at and analyzing multiple clinical cases and evaluating how a robot can be used to solve the issue. This is a vary crucial if not the most crucial step in this design process as an unclear identification of the problem leads to a design which does not fulfil the needs of the doctors, no matter how good the design is. This also applies to VEX as a robot which cannot perform the necessary actions to maximise points in the game cannot do well, no matter how well it is built.

The next stage of the design process at the company is a brainstorm of all the possible solutions which can be used to possibly solve the problem. This can be from a few ideas to hundreds of ideas to solve the issue. Each of these ideas are then represented as a flowchart to create an easily understandable process of how the idea works and how the different parts of the robot can work together to achieve this. An example of a flowchart used to perform an action is shown below:



The use of these flowcharts separate CMR Surgical from the rest of its competitors as planning out how to achieve a specific function of their robots using flowcharts beforehand saves time and money as problems are identified beforehand and therefore, they are less likely to produce prototypes which do not work in practice.

The next part of the design process at CMR is that once an idea is made about the robot and its functions, a 3D model of the robot is created in a CAD software and is simulated, allowing the design team at CMR to identify any problems in the concept of the robot and fix it. These simulations save time and money as they ensure that less failed prototypes are made. This process is also iterative as when problems are identified, the design team at CMR return back to the second stage of the design process and once again plan how the functions of the robot work. This part of the design process also applies to VEX as a CAD of every robot concept is necessary to plan out where the mechanisms of the robot can be placed and how it will work. An example of a surgical robot being made in CAD is shown below:



The next step in the design process after this is that a prototype of the robot is developed. A prototype is extremely useful, especially for robots which handle the lives of people. A prototype allows engineers to build 1 copy of the robot and ensure all of the functions of the robot work properly. This is important as the robot has to be examined and tested robustly to identify any issues that could harm its patients. If any issues are identified, the iterative process is repeated again and engineers try to solve the problem or create a new mechanism to fix the issue. Another prototype of the new machine is made and tested once again to identify any issues with the surgical robot. Once the robot is fully functional, the robot may be mass produced and delivered to hospitals which need it.

Through this design process of considering the needs of doctors and surgeons as well as creating a robust surgical robot, CMR Surgical have been able to create an easily portable (between operating rooms), easy-to-use and ergonomic surgical robot, making the company extremely successful and renowned.

How VEX Robotics prepares students for future careers.

VEX Robotics is a competition which promotes creativity, teamwork, leadership, as well as problem-solving skills. This makes VEX Robotics a perfect work-experience for students hoping to have careers involving STEM. However, the skills taught and learnt in vex do not only help in careers relating to STEM, but applies to all professions as these are key skills required in all careers, since all careers require some sort of teamwork and creativity skill, be it medicine or engineering or even art! Below are some of the key skills taught to students through the VEX Robotics program and how it prepares students for future careers:

- **Problem solving skills**

Problem-solving skills are extremely important in STEM-related careers such as engineering where solving issues are key to manufacture engineered products to solve problems faced by society such as the need for surgical robots

- **Programming skills**

Programming skills are also very important in the technologically advancing world where devices such as computers and phones need to be programmed to function. This is a requirement for most STEM-related professions.

- **Creativity**

Creativity is key to many jobs in the world. Top, renowned companies such as Apple, Google and Microsoft had to use creativity to invent solutions to make the lives of people easier. Creativity is promoted in VEX as lot as people must come up with innovative solutions to score as many points as possible in each year's games.

- **Teamwork**

Teamwork is also essential in most careers as collaborative work allows many unique ideas and skills to be combined to produce an innovative product. Teamwork is a key part of vex as unique skills sets can be distributed across the team to maximize the team's efficiency. An image of teamwork promoted in VEX is shown below:

