Computed Aided Surgery and Medical Robotics
Robot to Deliver the Surgical Instrument to Surgeon

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Introduction

Our project focuses on the development of a sophisticated system known as the TS-60 arm, designed to deliver a variety of surgical tools to the surgeon within the surgical room. The primary goal of this endeavor is to ensure the efficient transfer of specific instruments from a tool plate to a precise surgical location. The workflow of this system involves a series of essential operations, including tool requests, showing notifications, and the precise release of the instruments. This project represents a pivotal advancement in surgical robotics.

Objectives

In this project, the objective is to design and implement the TS-60 arm system to autonomously and efficiently deliver surgical tools to the surgeon, streamlining surgical procedures. Figure 1 shows the relevant working principle of the robot.

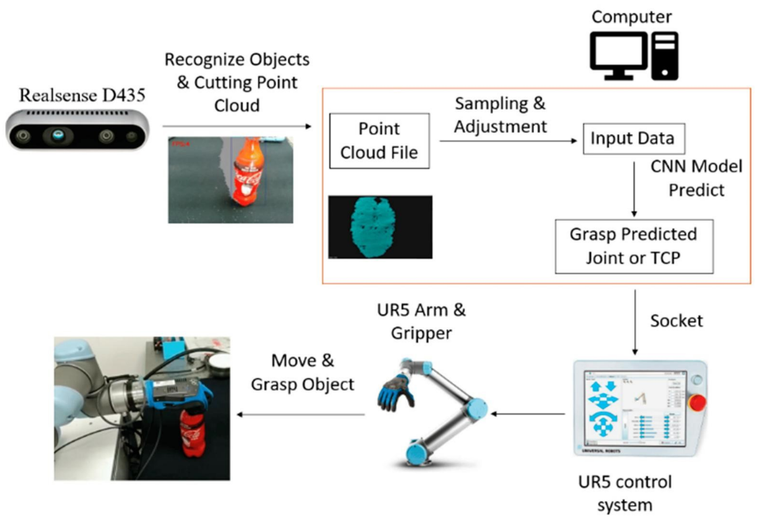

Figure 1. The working principle of the gripping robot [1]

Robot workflow

Following is the procedure for the robot that we will replicate:

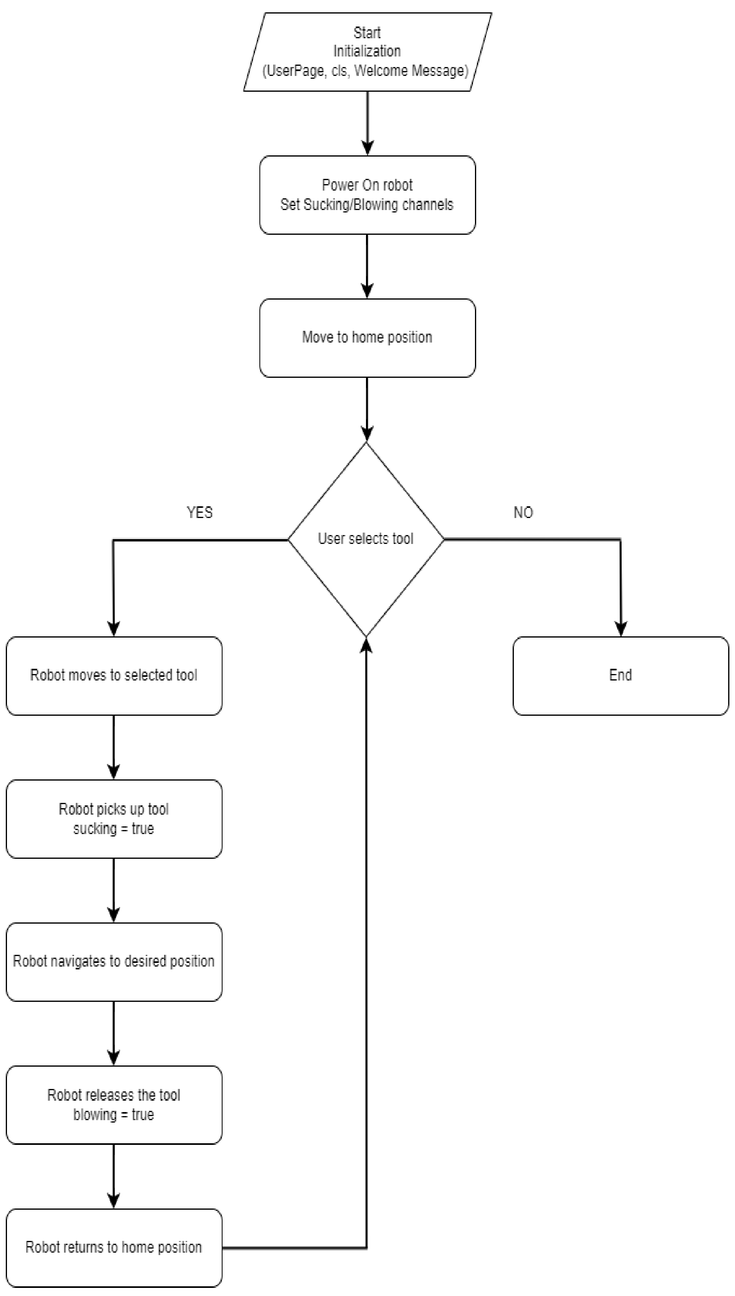

Figure 2. Block diagram of the robot

Methodology

The methodology for this project is divided into three main parts.

1. Calibration phase

The calibration phase involves using a marker tool to precisely calibrate three points on each plane: the tool frame and the final frame, enabling accurate frame calibration for subsequent operations. Next, we register the points of each surgical tool based on the center point of the objects, associating each coordinate with the corresponding pickup and delivery points.

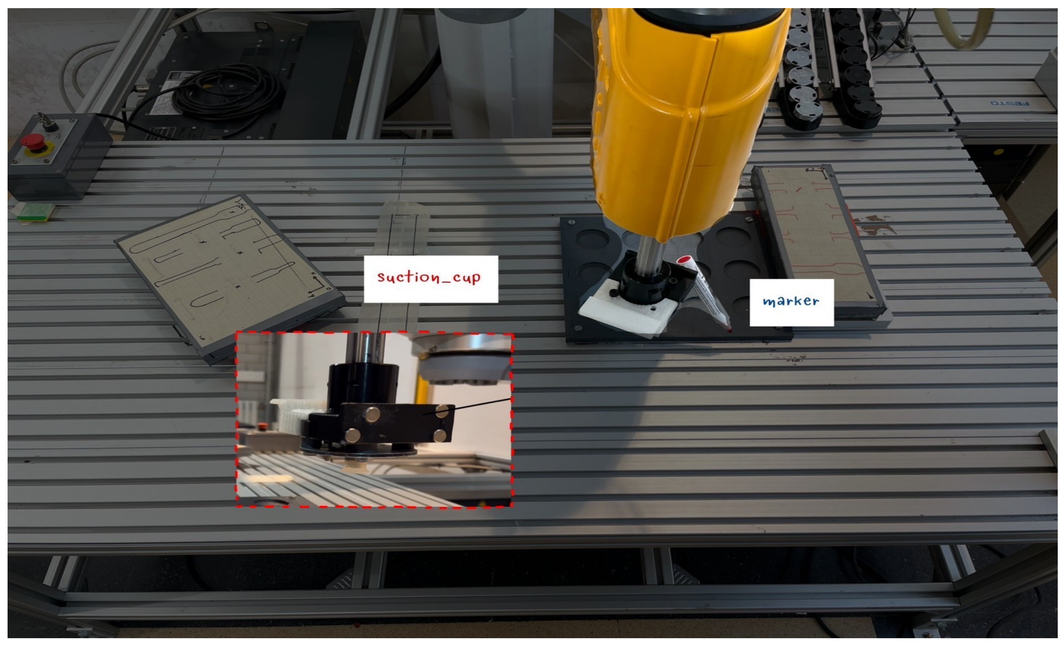

Figure 3. Tool definition

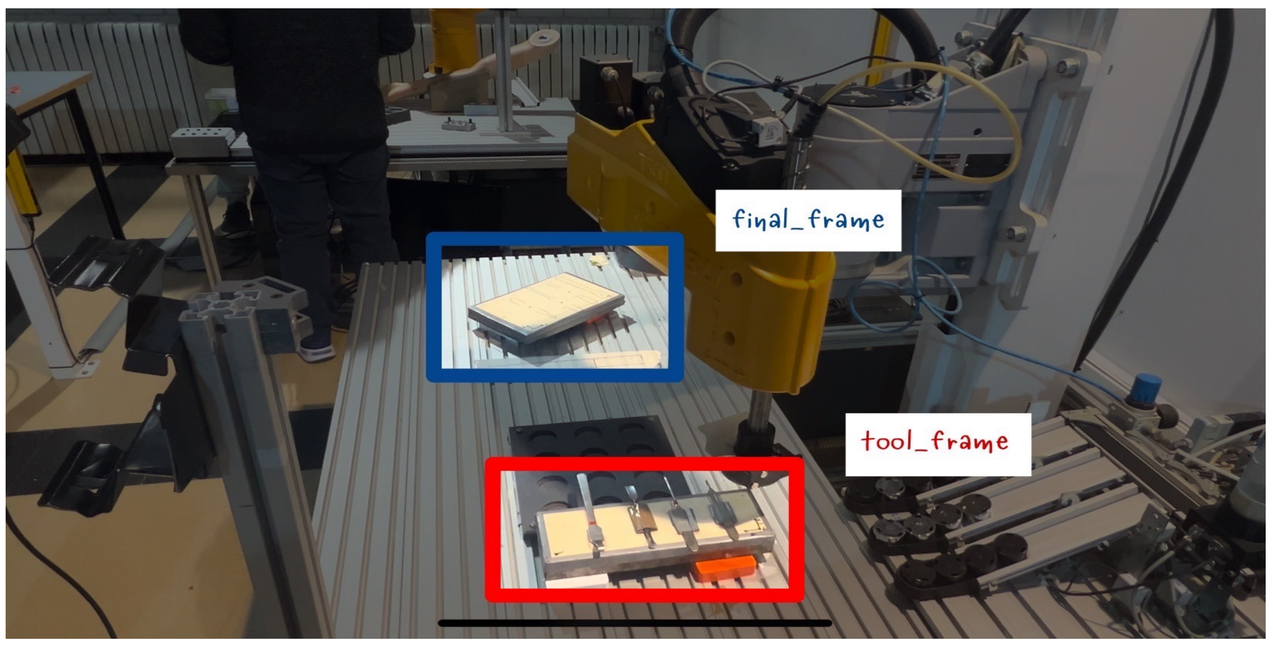

Figure 4. Frame definition

2. Implementation of code

The second part involves the implementation of code and variables to facilitate the robot's movement, as previously discussed, and the development of a user-friendly controller interface.

3. Final section

In the final section, we assess the results, refine the code as necessary, and gather materials to compile a comprehensive project report.

Result

Our project successfully achieved the desired outcome by implementing robot movements that effectively serve our objective of delivering surgical tools autonomously.

Conclusion

In conclusion, this project has yielded a significant accomplishment with the successful implementation of robotic movements to fulfill our objective of efficiently delivering surgical tools within the surgical room. This hands-on experience has deepened our understanding of practical applications in the field and equipped us with essential skills for future endeavors in robotics and automation.

References

[1] C.-S. Chen and N.-T. Hu, "Eye-in-hand robotic arm gripping system based on machine learning and state delay optimization," *Advances in Mechatronics Systems and Robotics: Sensing and Control*, vol. Sensors 23, 2023.