PURDUE UNIVERSITY NORTHWEST – TEAM 52: SAECTR

Sexual Assault Evidence Collection Training Robot

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OBJECTIVE

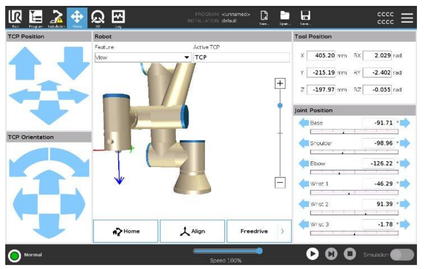
Many rape kits are collected incorrectly due to a shortage of trained Sexual Assault Nurse Examiners (SANEs), especially in rural areas. SANE training programs often struggle with high costs and a lack of medical volunteers to provide realistic practice. This creates a **critical need for alternative methods to help nurses gain necessary forensic experience**.

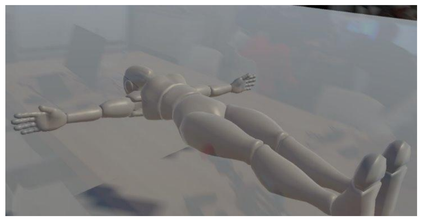
CUSTOMER PROBLEM AND BACKGROUND

Purdue Northwest has a top-notch forensics department that both teaches students various methods of forensics collections as well as researching ways to make these methods more accurate.
Charles Steele is a professor and researcher within this department, and he is the one who approached our team with the task of creating this SAECTR solution.

CONCEPTS AND EXPERIMENTATION

The combination of VR, robotics, and a live video feed ultimately did not work out as intended. While the idea was ambitious, integrating these components introduced significant complexity and failed to deliver the expected results. On the other hand, the VR simulation using the HoloLens 2 proved to be much more successful. We were able to simulate a model of the human body within a virtual environment using Unity, demonstrating the platform's capabilities for immersive and interactive educational content. This simulation has significant potential for future development. With further additions, it could realistically incorporate more aspects of medical procedures or training scenarios, making it a powerful tool for learning and practice. In parallel, we explored the control of a robotic system using ROS 2 and Ubuntu. While this setup produced some promising early results and offered the possibility of integrating features like haptic feedback, it came with high costs and limited practical benefits when compared to the VR solution. The robotic approach, although technically impressive, offered few advantages over the much simpler and more flexible virtual simulation. It also required many interconnected components that added to the system's complexity and potential failure points. Overall, our findings suggest that the VR simulation offers the most practical and impactful path forward, particularly as a training tool featuring visual examples, interactive prompts, and tutorial-based content.



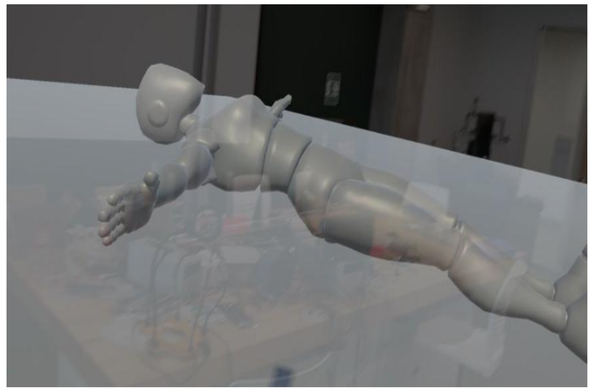


REQUIREMENTS AND FINAL DESIGN

The ideal solution needs to be realistic, feasible, and adaptable, with the potential to be developed into a more comprehensive system in the future.
Our answer to this is a VR simulation: Built on Unity, the user will be transported into a virtual reality simulation of an exam room with instructional prompts based on standardized training guidelines to aid their learning. This user will perform any number of evidence collection procedures on a simulated analog of a patient. This patient may respond, move, recite recorded voice lines, or otherwise react to the user's input.
Our most successful prototype was the VR simulation in Unity with the HoloLens 2. This consists of a of the surrounding area and a virtual representation of a human body that can be added onto to further simulate an evidence collection procedure. The merits of this system include the immersion and the ability to add instructional material into the program to help reinforce the user's training.
This is our ideal design solution and our proof-of-concept implementation for this scenario. Through our implementation of a Unity simulation on the HoloLens 2, we have demonstrated the feasibility of a system like this.

TESTING RESULTS

Our most successful prototype was the VR simulation in Unity with the HoloLens2. This consists of a of the surrounding area and a virtual 3D representation of a human body that can be further augmented to simulate an evidence collection procedure. The merits of this system include the immersion and the ability to add instructional material into the program to help reinforce the user's training.



CONCLUSION AND RECOMMENDATIONS

This system shows promise, particularly in its virtual reality component. The VR aspect proves to be both efficient and flexible, offering a highly adaptable platform for training and education. It allows users to engage with content interactively and immersivity, making it a strong candidate for developing training programs or instructional tools. In contrast, the robotic element, while technically feasible, offers limited practical value. Our experience demonstrated that incorporating robotics introduced unnecessary complexity. The system required numerous interconnected and interdependent mechanical parts, which not only increased the risk of failure but also complicated the overall setup without significantly enhancing the user experience. Through this project, we learned that the robot doesn't contribute much to the system's core purpose. Instead, the virtual component stands out as the most effective part of the design. Moving forward, the most practical application would be a VR-based training video game that includes visual examples, user prompts, and interactive tutorials. This streamlined approach would maximize impact while minimizing unnecessary hardware and complexity.