SolidWorks Modeling of a Portable CNT X-ray System

Gavin Lyda, Christina Inscoe, Otto Zhou, Jianping Lu, Yueh Z Lee

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Abstract

This research integrates carbon nanotube (CNT) technology into portable DRX systems for quasi-three-dimensional bedside imaging, addressing limitations such as structural overlap and suboptimal patient positioning in current mobile x-ray methods[1]. Using Solidworks modeling, we pave the way for seamless CNT integration, surpassing traditional mobile x-ray capabilities. Tomosynthesis captures multiple low-dose x-ray projections for superior diagnostic accuracy. CNT incorporation enhances resolution and sensitivity, improving bedside diagnostics. We consider system size, weight, and compatibility for optimal performance and patient accessibility.

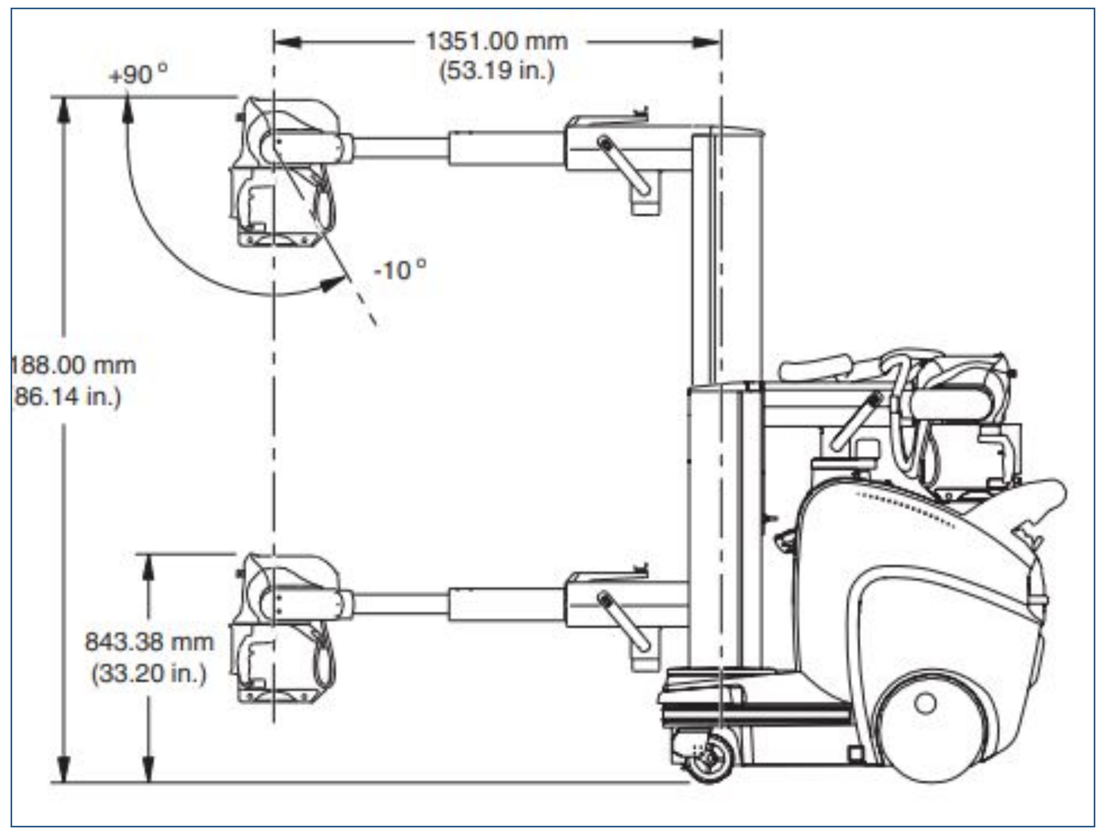

Figure 1. DRX Revolution Side Profile

Background and Methodology

ICU patients require immediate diagnosis and continuous monitoring of their rapidly changing medical conditions. Mobile x-ray systems enable healthcare providers to quickly assess patients' status at their bedside, minimizing transport risks and facilitating timely intervention. By incorporating CNT technology, which offers high electrical conductivity and mechanical strength, these systems can achieve improved resolution and sensitivity, crucial for accurate diagnostics in the intensive care setting.[2]

Design

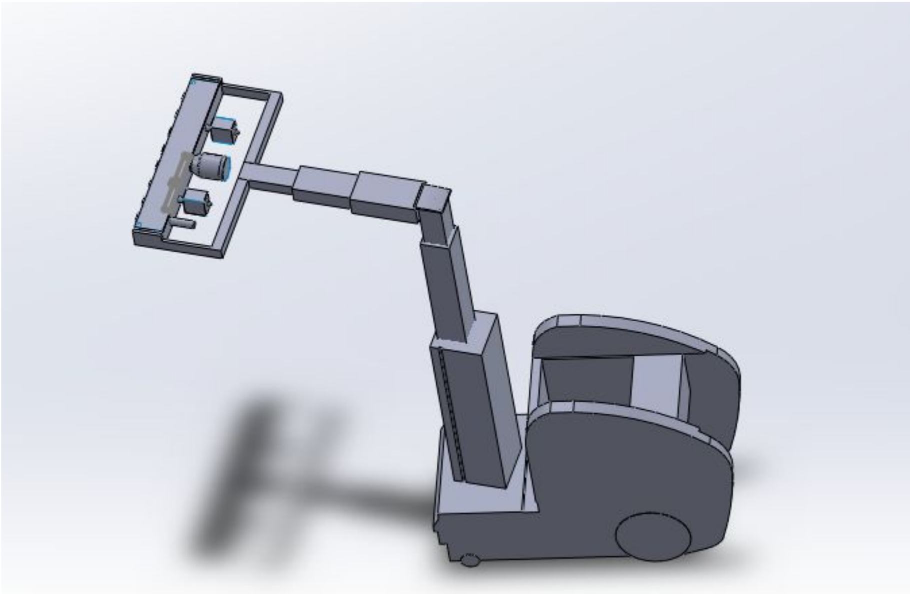

Figure 2. Three-dimensional model of CNT mobile x-ray device, visualizing free space for batteries and other necessary electronic components

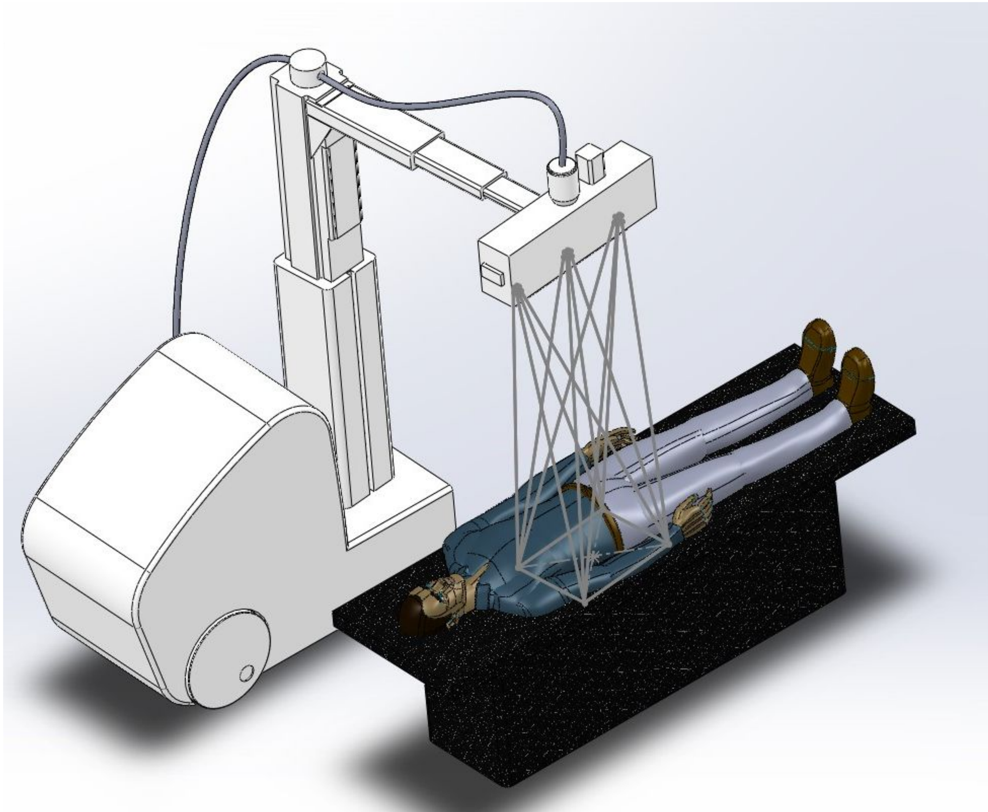

Figure 3. CNT patient imaging. The lines represent multiple x-ray beam projections, all collimated to fall within the detector

Figure 4. MED1263 CNT x-ray tube in action.

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Discussion

Design Considerations and Challenges

In integrating Carbon Nanotube (CNT) technology into the existing portable DRX revolution system, several key considerations and challenges emerge, notably surrounding portability and cost-effectiveness. Ensuring the system remains lightweight and compact while accommodating the additional components of CNT technology poses a significant design challenge. Striking a balance between portability and functionality is crucial to maintain the system's usability and mobility in diverse clinical settings. Moreover, the integration of CNT technology must be cost-effective to ensure widespread adoption in healthcare facilities of varying budgets. Achieving these goals requires meticulous design optimization and material selection. Throughout the design process, addressing these considerations will be pivotal in developing a CNT-enhanced portable x-ray system that offers enhanced imaging capabilities without compromising on either portability or affordability.

Next Steps

Continued efforts will focus on integrating CNT components into the DRX Revolution model. Following successful integration, researchers will assemble the system for thorough testing, evaluating performance and reliability across diverse scenarios. The ultimate aim is to finalize a robust and efficient CNT-enhanced DRX Revolution system, ready for deployment in clinical environments.

References

[1] Inscoe, C. R., Billingsley, A. J., Zhao, A., Burel, H. L.-J., Chesser, S., Lyda, G., Lu, J., Lee, Y. Z., & Zhou, O. (2024). X-ray source array optimization for mobile chest tomosynthesis. *Medical Imaging 2024: Physics of Medical Imaging*. https://doi.org/10.1117/12.3006912

[2] Parmee, R. J., Collins, C. M., Milne, W. I., & Cole, M. T. (2015). X-ray generation using carbon nanotubes. *Nano Convergence*, *2*(1). https://doi.org/10.1186/s40580-014-0034-2