Team #22

Computer Vision Quality Assurance for Medical Linear Accelerators

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Introduction/Background

Medical Linear Accelerators (Linacs) are the primary tool for radiation therapy for cancer patients, being instruments valued for their efficient and non-invasive delivery of treatment. The accuracy and the consistency of existing mechanical QA tools for medical linear accelerators are limited by their heavy reliance on subjective, manual measurement. There exists a prevalent need in the market for advancements in automated measurement tools for mechanical QA testing.

Mission Statement

StriX aims to advance radiation therapy outcomes through the innovation of precise, efficient, and automated devices for the testing and quality assurance of medical linear accelerators.

Final Technical Model

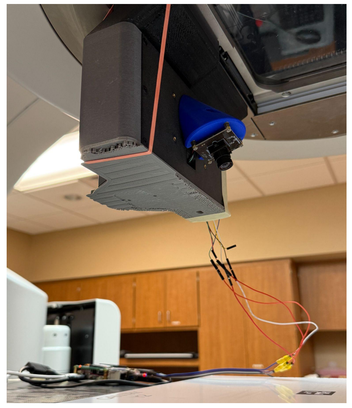
$$t = \frac{2V_0 sin(a)}{g}$$

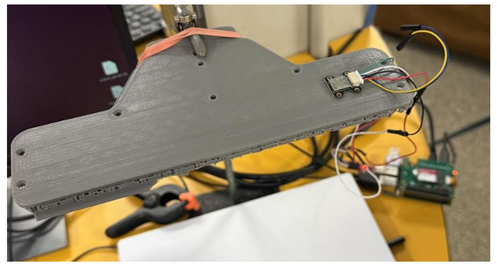
t = time of flight, Vo= initial velocity, a = angle of launch, g = gravitational acceleration

Final Product Specifications

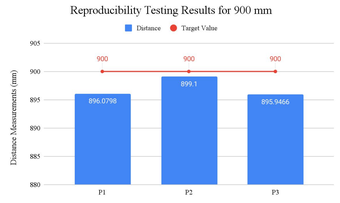
StriX	ToF Laser Distance Sensor	Raspberry Pi 5	3D Printed Body	Software
Description	940-950 nm infrared laser wavelength	Central data acquisition and processing	Additive manufactured physical housing	C++ custom made scripts
Material	PCB-mounted sensor with protective housing	FR-4 PCB, integrated SoC package	Polylactic Acid (PLA) filament	QT Creator
Power	3-5 V (DC)	5 V (DC)	N/A	N/A
Current	40 mA	5 A	N/A	N/A
Dimensions	18 mm x 17mm x 7 mm	85 mm x 56 mm x 1.6 mm	22 cm x 5 cm x 0.12 cm	Integrated software

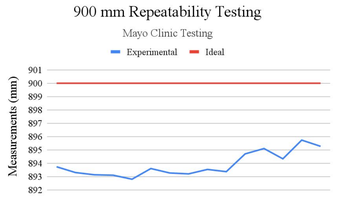
Prototype

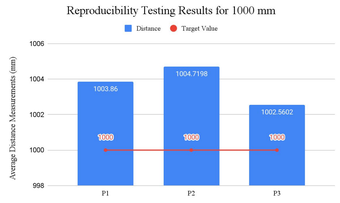


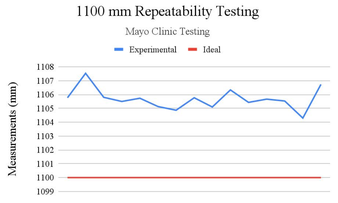


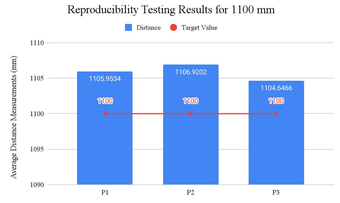
Verification Results

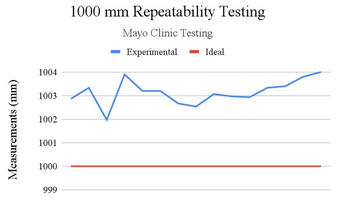






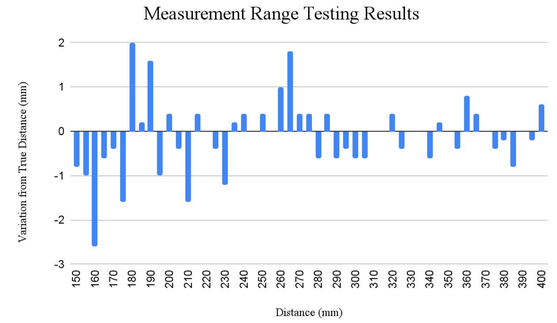






Verification Results

Distance	900 mm	1000 mm	1100 mm
Repeatability Coefficient of Variance	0.10%	0.05%	0.07%
Reproducibility Coefficient of Variance	0.15%	0.13%	0.16%



Future Work

The team recommends continued investment into the project in order to purchase a measurement component that outputs distances at the sub-millimeter level. Having this investment and continued software development will lead to the success of an automated process for verifying the optical distance indicator and vertical offset.

Acknowledgements

We would like to express our gratitude to Dr. Daniel Robertson, Mike Armstrong, Prof. Vincent Pizziconi, and Prof. Bradley Greger for their advice, assistance, and insight throughout the capstone experience.

Links: