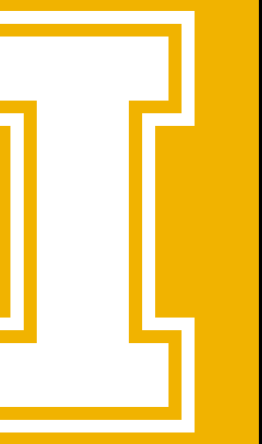


NIGHTFORCE AUTOMATED RING ASSEMBLY MACHINE

Bryce Hendrickson, Lane Pierce, Luke Presta, Josiah Widmayer

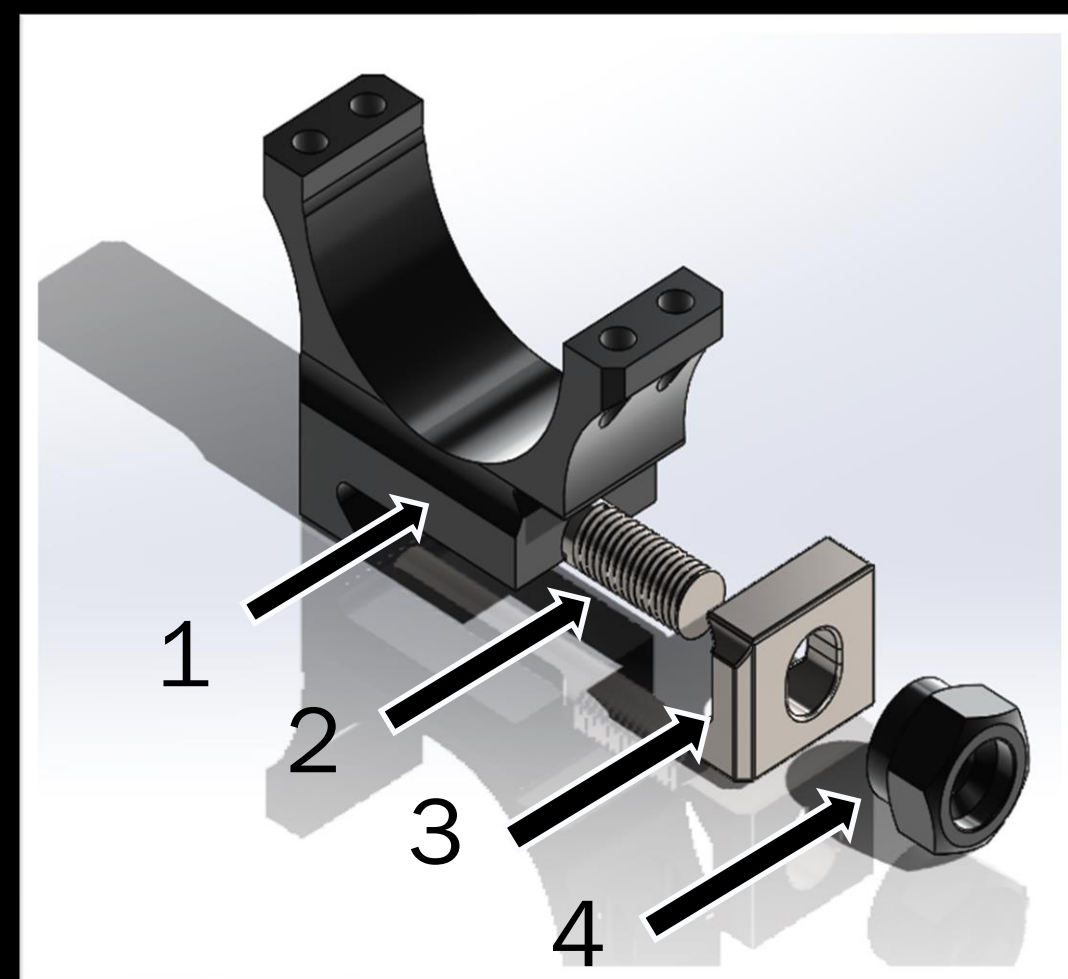


OBJECTIVE

To design and manufacture a working prototype that will automate the first two stages of the current assembly process, as well as allow room for modularity to produce a complete machine in the future.

BACKGROUND

Nightforce assembles and packages all riflescope rings by hand and are looking for ways to improve efficiency and operator comfort.



Components:

- I 1) Ring Base
- I 2) Crossbolt
- I 3) Clamp
- I 4) Nut

VALUE PROPOSITION

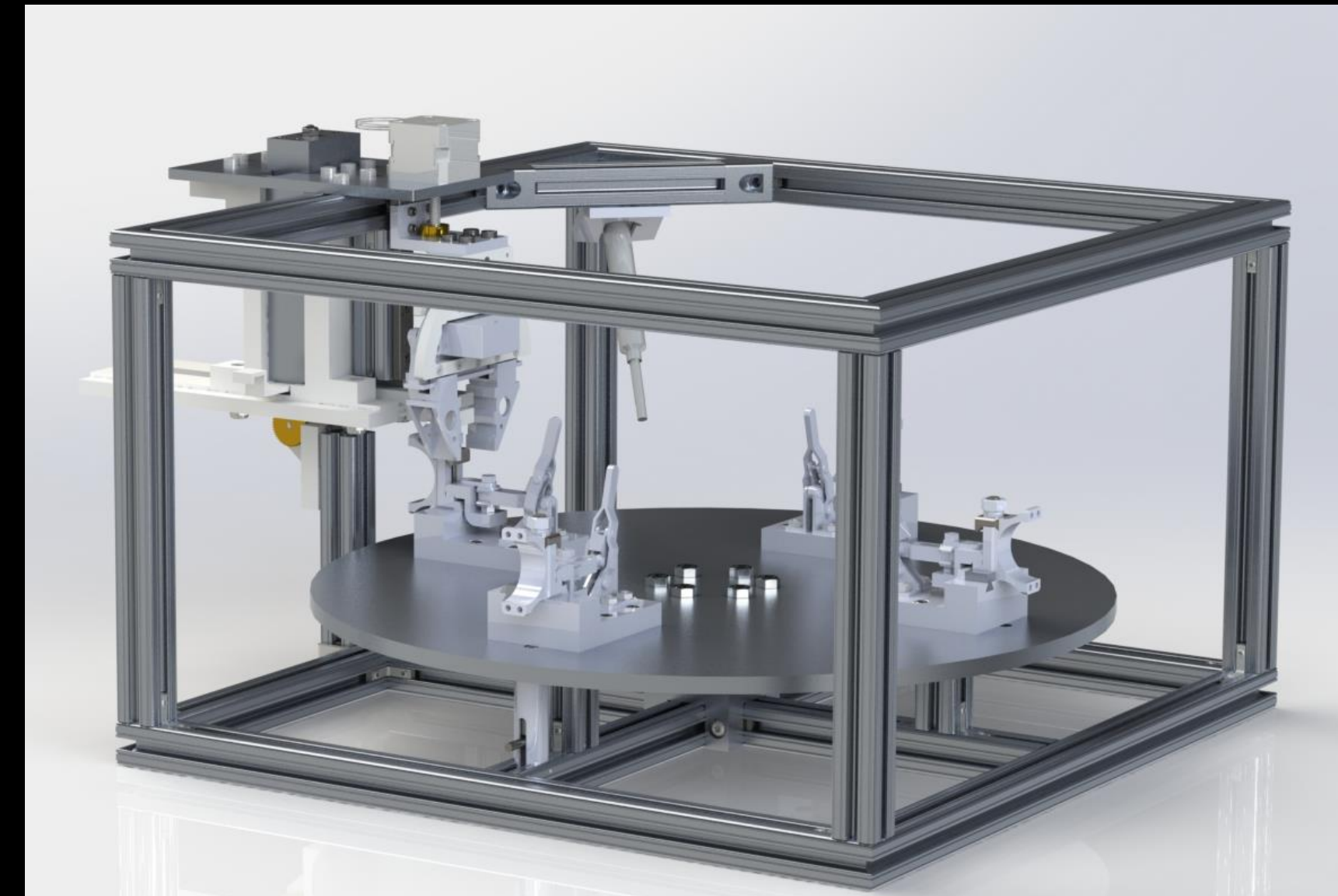
Around \$80 billion dollars are lost every year by companies due to workplace injuries attributed to cumulative trauma or overuse. Our design will reduce injuries, improve operator comfort & increase overall efficiency on the assembly floor.

KEY REQUIREMENTS

- I No dangerous repetitive tasks required for operators.
- I Place pic-rail clamp and apply anti-seize to ring base.
- I Compatibility for current pneumatic and electrical systems at Nightforce.
- I Modularity for future improvements and operations to be added.

CONCEPT DEVELOPMENT

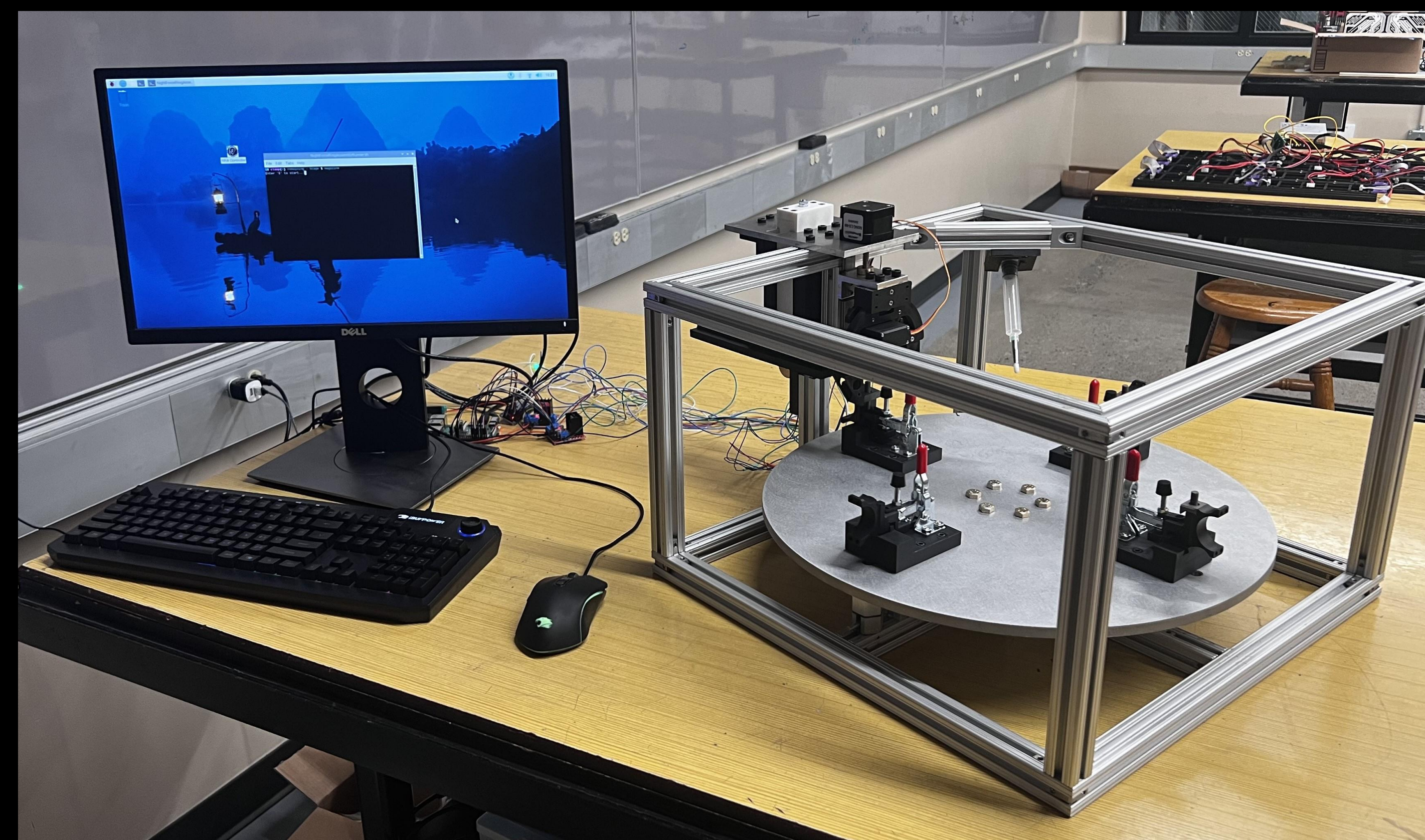
A linear, rotary, and internal-rotary automated assembly systems were all developed as early conceptual ideas for our final product. Our final revision of our SolidWorks design utilized a box frame of 80-20 and a locking detent system to allow for modularity and easy alignment of the ring base to each operation.



This design allows for easy loading/unloading of ring bases, as well as room for the clamp installation and anti-seize application operations. Being able to install future stages for the remaining operations will be easy and require minimal alterations.

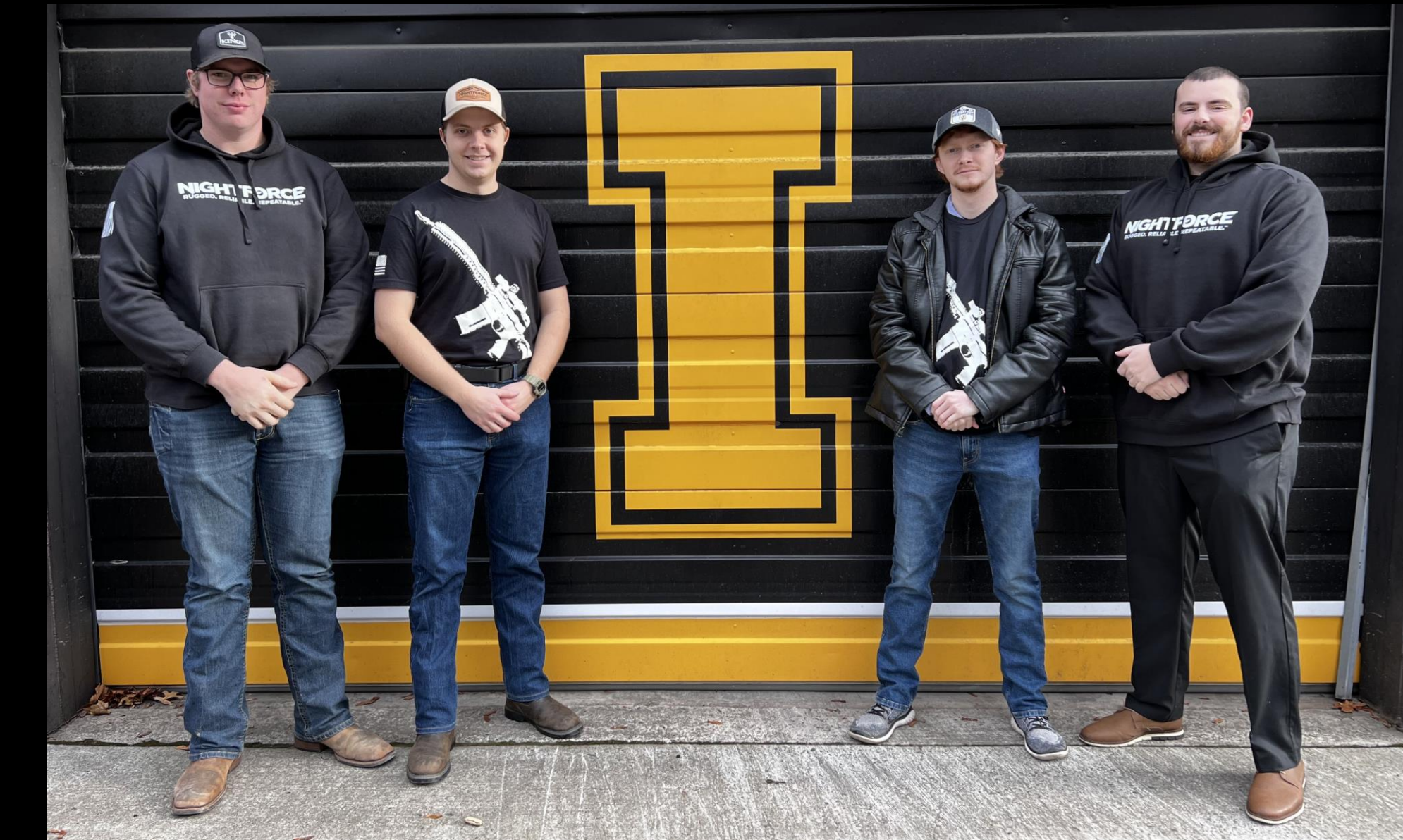
THE FINAL DESIGN

After machining and printing all the necessary parts, our physical prototype was ready to program. We utilized a combination of stepper and servo motors to operate the functions of the clamp installation and run our Python program off a Raspberry Pi controller.



SPECIAL THANKS TO:

Nightforce Optics, Grant Minor, Jake Elliott, Ian Novasio, Lead Instructor Matthew Swenson, Graduate Mentor Dan Revard, and Shop Manager Brian Petty



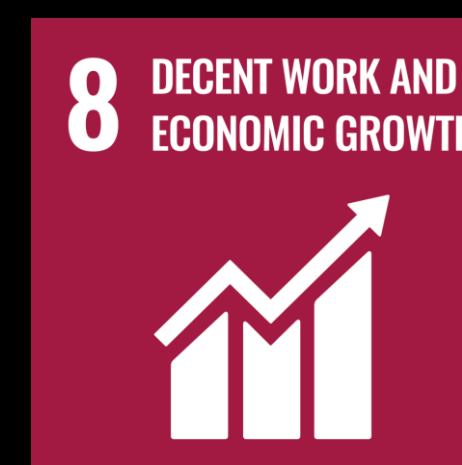
Lane Pierce, Josiah Widmayer, Bryce Hendrickson, Luke Presta

SUMMARY

- I Our prototype succeeded in being a proof-of-concept for future applications that Nightforce may have for manual tasks that could be automated.
- I Our prototype also met our key requirements given to us by Nightforce and was able to place clamps onto the ring base as well as apply anti-seize to the crossbolt threads.

RECOMMENDATIONS

- I Parts that are 3D-printed should be machined to be more durable. The modular fixtures to hold the ring bases will benefit from this if force is required to deform the crossbolt threads in the future.
- I Instead of a magazine-fed system which requires the operator to load parts, future designs should implement a vibratory bowl feeder to self-align and load parts for complete automation and require less "hands on" attention from operator.



2024 Capstone Project