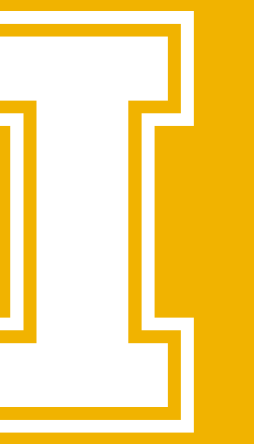


INTENSITY-BASED ALIGNMENT OF LASER DEVICES



Developed By: Track Tech

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Lead Instructor: Bruce Bolden

Client: JP Hansen – Hansen Photonics

OBJECTIVE

Automate alignment of an optical receiver to a laser source, based on the measured light intensity at different positions. Reach optimal alignment by achieving maximum intensity.

BACKGROUND

Hansen Photonics Inc. is a small, family company located in Burien, Washington. They contribute to the computer networking industry with patents that cover modular networking hardware devices and systems. HPI works with universities, environmental science centers, and small businesses to help provide new, cutting-edge hardware solutions for everyone.

VALUE PROPOSITION

Optical transfer allows for greater data transfer capacity than electrically. It can be implemented in a cost effective and environmentally friendly way via lasers. This requires very precise alignment between two devices, potentially taking hours of labor to establish a connection. Automating the alignment with software provides significant convenience.

KEY REQUIREMENTS

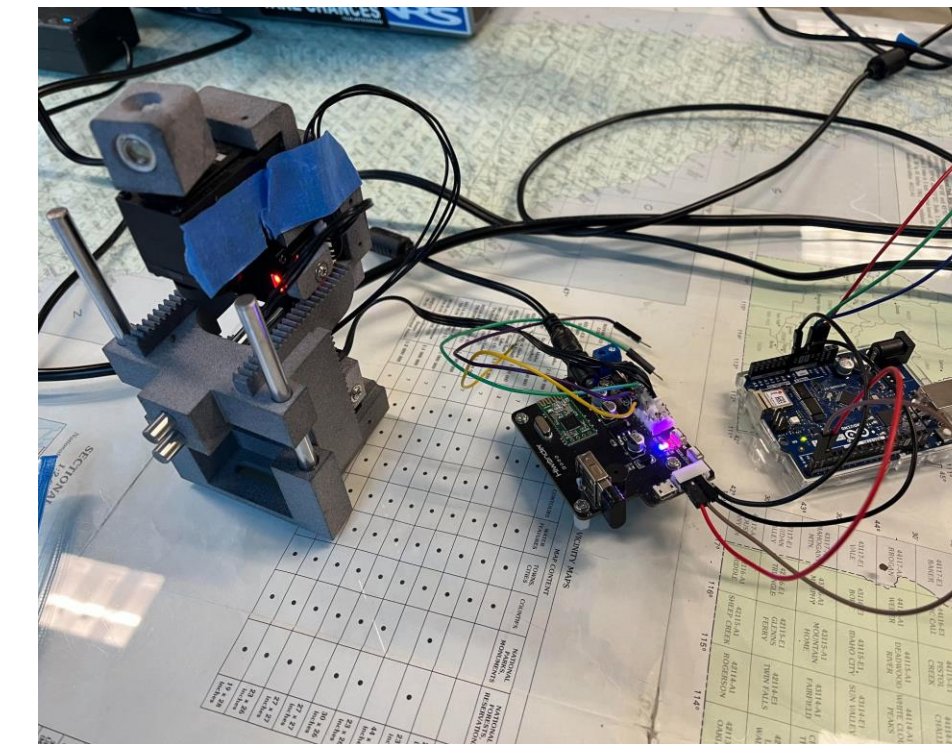
1. This alignment process shall work at a minimum distance of 6 feet.
2. After program is started, the alignment process is fully automatic.
3. The finished device weighs less than 10 lbs.
4. The program is written in a modular, scalable style.

CONCEPTUAL DEVELOPMENT

Design software for alignment of laser devices via optical intensity.

Language: Arduino C++

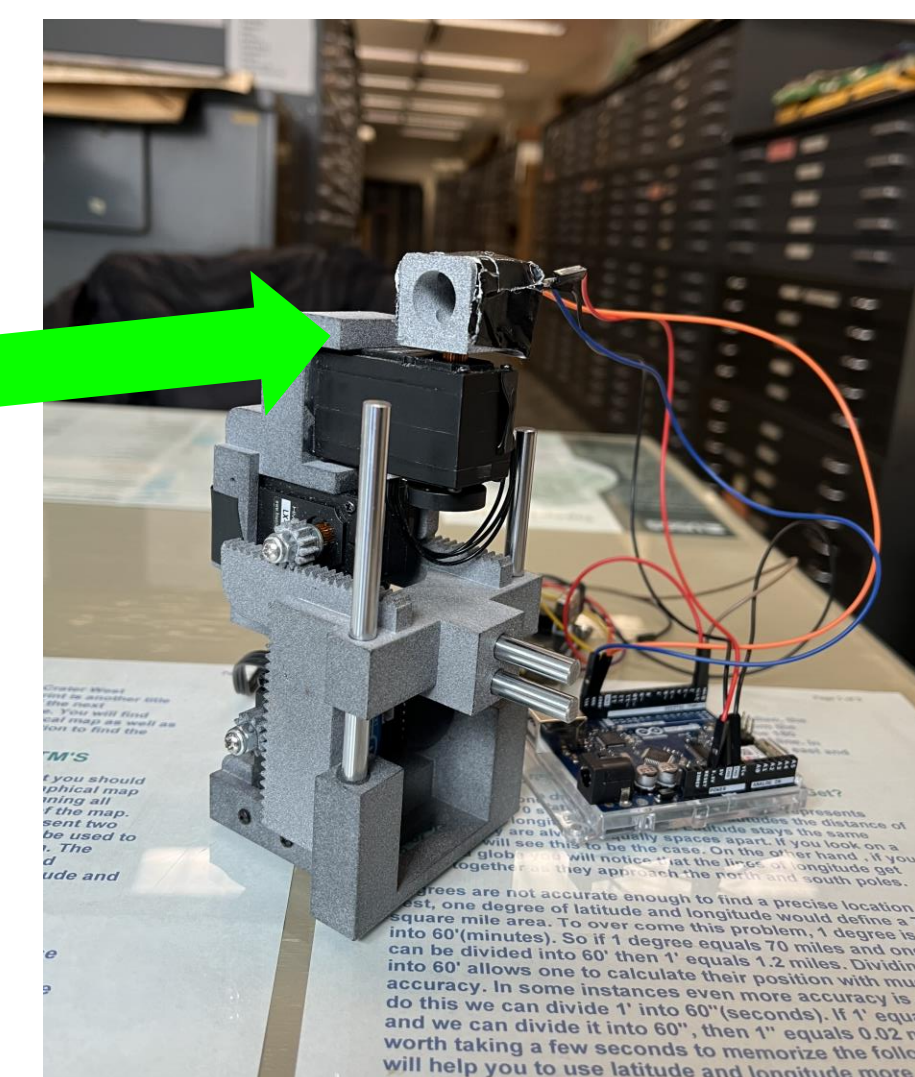
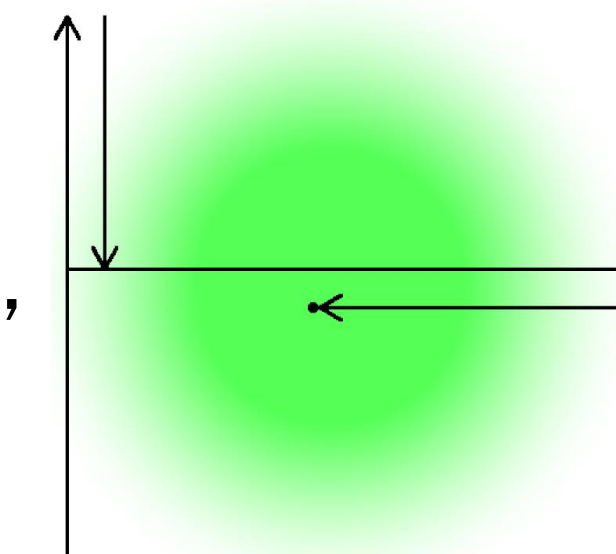
Environments: VS Code Platform IO



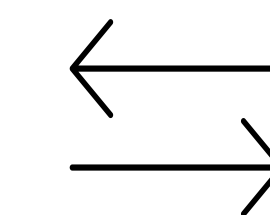
FINAL DESIGN

Final Process:

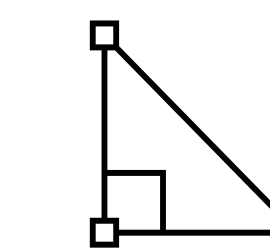
1. Find the brightest position along the R-axis, corresponding to the angle towards the broad light source.
2. Switch the light sensor to lowest gain, to support measuring the laser, which is very bright.
3. Alternate between optimizing along the X, Y, and R axes, searching for the brightest point upon each.
4. Continue until reaching a point where the measured value is sufficiently large.



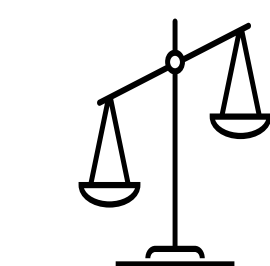
VALIDATION



1. Alignment worked at 6 feet.



2. Alignment worked at minor offset angles, as well as at 45 and 90 degrees.



3. Transmitter weighs 1.25lbs and receiver weighs 1.06lbs.



4. Alignment does not require user input after beginning the process.

CONCLUSION

The alignment process created meets the desired requirements, aligning the laser to the receiver. However, it may take several minutes, and the receiver may stop when reaching the side of the laser rather than the center. Further development could optimize the speed of the alignment or ensure that the receiver always reaches the exact center of the laser.

ACKNOWLEDGEMENTS

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