Castle Nut Alignment Socket

Kubota

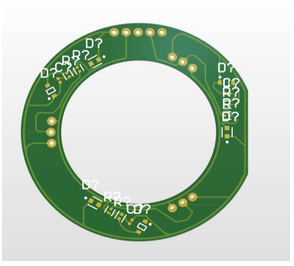
PROBLEM STATEMENT

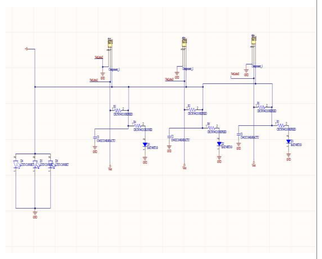
Kubota is facing a challenge in aligning a castle nut with bolt holes for easy cotter pin installation without hand tools. They aim to use the ESTIC tool to tighten and torque the castle nut in one operation, reducing production time for the BX tractor's front axle assembly. They also seek to adapt this solution for other product lines that use similar castle nuts.

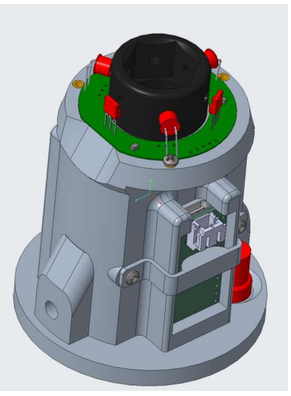
REQUIREMENTS

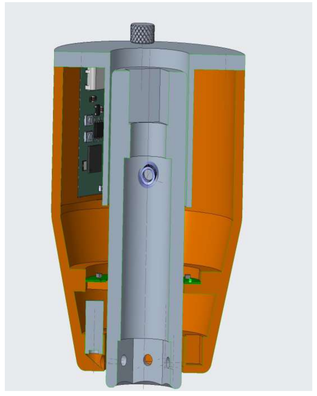
#	Description
1	Durability
2	Last an entire shift
3	Interface with Estic tool tray
4	Transmit signal to the Estic tool to stop
5	Reduce current cycle time
6	Must be able to withstand harsh environments including minor impacts, grease.

CONCEPT/DEVLOPMENT









FINAL DESIGN, APPROACH, PLAN

The team developed a tool to secure the 17 mm socket along with three lasers in the tool. This tool will the capability to fit onto the castle nut to torque the castle nut to the appropriate specification.

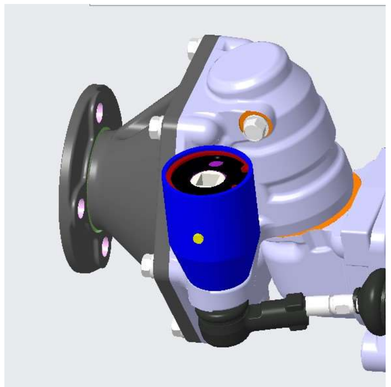
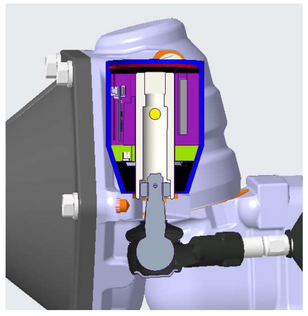
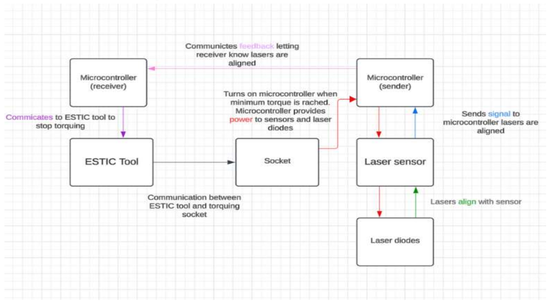


Photo Caption: Assembled Tool on BX Tractor Front Axle .

Graph heading



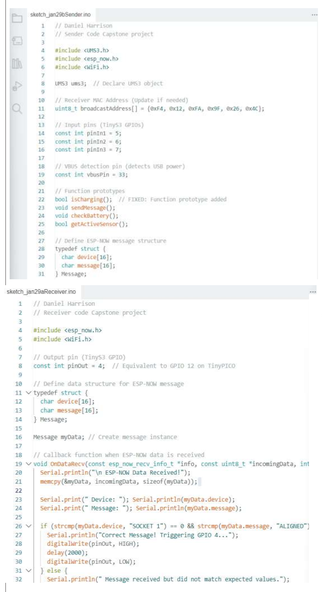
Flow chart of operation



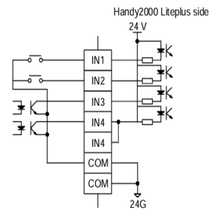
RESULTS

The design establishes that minimum torque is met first, once this happens it switches an internal relay on the ESTIC, this then energizes a 24V external relay, allowing a 3.3V circuit to close on the receiver ESP32. This activates the laser sensors on the sender ESP32, and when the socket is aligned, this sends a signal back to the receiver that energizes a 3.3V relay to allow the tool to stop once the job is complete.

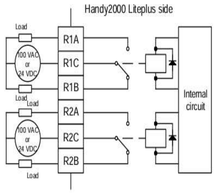
Laser Alignment code and relay logic

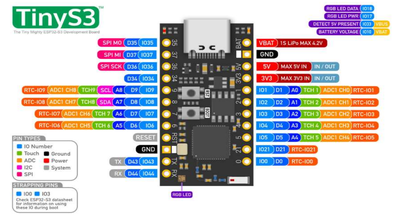


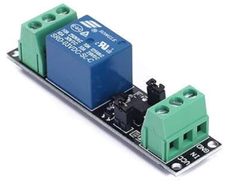
Wiring diagram



<Wiring diagram>







CONCLUSIONS

Castle Nut Alignment Socket

- Provides a compact and efficient method to communicate to ESTIC system
- Eliminates operator decision-making during assembly
- Provides an external casing that protects the internal electronics
- Aligns castle nut with the tie rod completely digitally
- Communicates with ESTIC with a custom-made socket tray when socket is removed/returned for job start/finish

ESTIC Logic

- Utilizes built in PLC logic to switch internal relay
- External relays communicate to the Socket tool, alerting that the minimum torque has been met & also sets a high signal to turn tool off when lasers are aligned

TEAM & ACKNOWLEDGEMENTS

- **Dawson Thompson** (Engineering Technology)
- **Daniel Harrison** (Electrical Engineering)
- **Alex Borrelli** (Engineering Technology)
- **Blaine Doolittle** (Mechanical Engineering)
- **Brett Banther** (Faculty Mentor)
- **Shawn Lyvers** (RAPID Center)
- **Avery Webster, Chris Aratari, Chad Medlin** (Sponsors)