AGV (Automated Guided Vehicle) On Board Charging

KUBOTA

Western Carolina University

PROBLEM STATEMENT

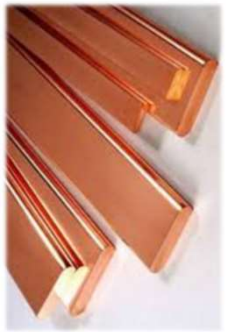
- Kubota wants a way for their AGVs to be able to charge while working
- Current solution requires workers to manually move AGVs to a drop cord to charge.
- With 2nd 10-hour shift added, that only leaves 4 hours of charging for roughly 100 AGVs
- AGVs have two 12-volt batteries that are in series which works as a 24-volt battery

REQUIREMENTS

#	Description
1	Safety is Kubota's #1 priority. Concepts must follow Kubota safety guidelines. Concept ideas must be safety guards to prevent anyone from hurting themselves accidently and intentionally.
2	Positive net power output
3	Must not affect cycle time
4	Must be able to withstand harsh environments including dirt, dust, minor impacts, and damp environments
5	Concept must be adjustable. That way in the future if Kubota makes any modifications to AGVs (x, y, z) coordinates, maintenance can easily change height/position.

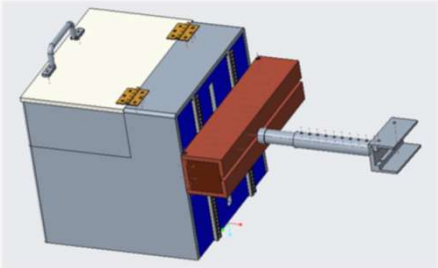
CONCEPTS

- Initial concepts that were considered approaches
  - Alternator/Belt
  - Wireless Charging
  - Copper Bar Contact



FINAL DESIGN, APPROACH, PLAN

The team created two separate boxes, as well as an adjustable arm to enable adjustability in 3 different directions per Kubota's request.



Charging Box:
- Responsible for holding electrical components and NOCO charger
- Plexiglass accessibility compartment for NOCO Charger & removable wall
- LED indicator stating status of Busbar

Guarding Box:
- Spring loaded hinged doors for safety
- Gap less than a finger width to disable people from touching live busbar
- Adjustable via 80/20 for height

Arm:
- Adjustable length in tubing
- Engineered C-clamp made from aluminum for strength to connect to the AGV

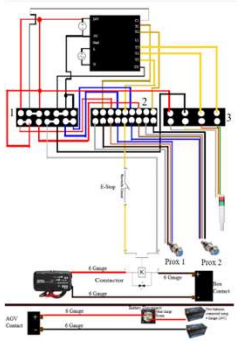
Electrical Components:
- 2 Proximity sensors
- Click PLC
- Tower Light
- Bus Bar Contact
- Contactor/Relay
- NOCO Charger

PLC:
The two proximity sensors are used to turn on and off the bus bar's when the AGV passes by. When the first prox. sensor is triggered the bus bar contactor electrifies the bus bars and the tower light switches from green to red. When the second prox. Sensor is triggered the bus bars turn off and the tower light switches back from red to green

RESULTS

The construction of the station went mostly as planned. However, due to a lack of testing in the PLC and electrical components, the product does not fully work.

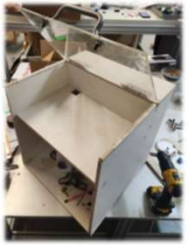
Wiring Diagram:

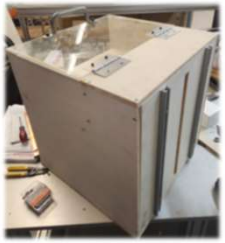


Electrical Test Results:

Test #	Light	E-Stop	Voltage
1	Green	On	0.7
	Green	Off	0.6
	Red	On	0.7
	Red	Off	0
2	Green	On	0.7
	Green	Off	0.7
	Red	On	0.6
	Red	Off	0
3	Green	On	0.7
	Green	Off	0.7
	Red	On	0.7
	Red	Off	0

The guarding box, charging box, and adjustable arm were all made to plan with little issues. The team ran into some supply troubles and used select parts from WCU's machine shop as replacement. Otherwise, the parts were completed.





SUMMARY AND CONCLUSIONS

The team anticipates a complete product. The mechanical components of the project are complete, and the electrical components are complete, but the bus bars are not getting as much power as they should be.

Many requirements set in place for the project were completed such as the adjustability in three different directions, as well as an out of the way product solution that will charge the AGV while it is still on its route.

With more time, the team would expect to be able to see the product working alongside an AGV at Kubota

FUTURE WORK

The Charging box and the guarding box will need to be made from a heat resistant plastic so the heat and electricity from the bus bars will not be dangerous. The contact mount will need to be machined to prevent breaks from collision and wear. The interfacing from the contact and the bus bars will need to be perfected.

On the electrical side, the problems with the bus bars not getting enough power will need to be addressed, There will need to be more testing so the problem can be found and fixed.

TEAM & ACKNOWLEDGEMENTS

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