MDCS Connector

RED ROCKS COMMUNITY COLLEGE

Background

E-waste is a global problem, and addressing it effectively starts at the local level[1]. We chose to focus on cable waste in university campuses, corporate offices, and tech companies—major hotspots for cable accumulation. Implementing solutions in these environments can significantly reduce invisible e-waste at its source [2].

Key Stakeholder input:

Stakeholder	Input / What We Learned
Electrician	How connectors are built, used, and commonly fail in real-world applications.
Electronics Recyclers	Cables are low-value, low-priority items; often arrive mixed in bulk; sorting/testing is time-consuming; many end up discarded
Western Union Supply Manager	Large companies rarely track cables; employees discard them reflexively rather than test or reuse them.
IT Department Workers	Functional cables pile up in large boxes; IT routinely replaces cables pre-emptively; little time or staffing is available to test, sort, or responsibly redistribute cable stock.

Problem Definition

"How can we reduce cable waste to landfills and recyclers by creating a more repairable, modular, and adaptable alternative?"

Cost & Risk Analysis

Item	Unit	Unit cost	Quantity	Total Cost
USB - C Connector	each	$0.50	20	$10.00
Lead-free Solder Wire	gram	$0.45	160	$9.00
Plastic Components	kilo gram	$1.49	43.6 * 10^-3 kg	$0.06
Labor* Assembly	per hour	20$	20	$66.67
Subtotal				$85.73
Mark-up		35%		$30.01
Price Per Batch				$115.74

Table 1.
The cost of manufacturing the various different components for a batch of 20 MDCS Connectors with a unit price of 5.79$
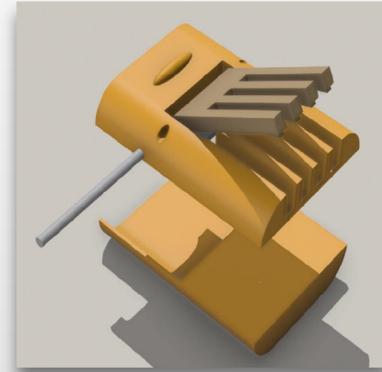
Subsystems

Figure 2. Intercalary connector
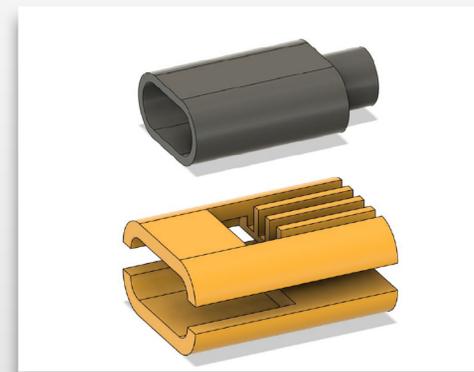Union between users cable and MDCS [5]

Figure 3. Housing
Outer housing and the two-piece inner container used to secure the USB-C head and support internal components.
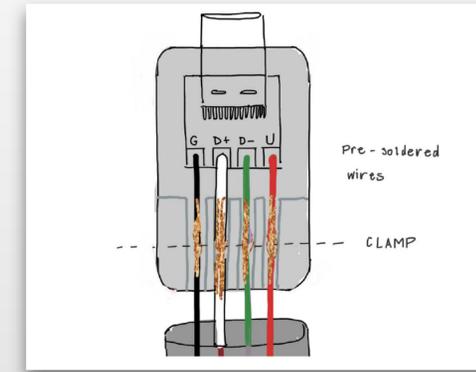

Figure 4. Internal Wiring Interface
Technical drawing of the intended internal wire system that allows connectivity between USB-C header and the old cable [3]
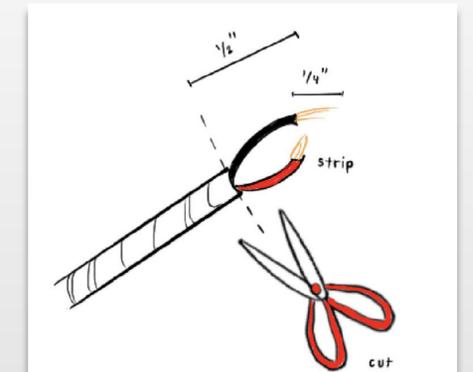

Figure 5. User Interface
Instruction on how to prepare wire for MDCS Connector attachment

Design Solution

- Uses a rake-style clamp to secure the wires.
- Clamp engages when the outer housing slides over the inner container.
- Outer housing provides the pressure needed to hold the clamp and protect the electronics while withstanding a 20N pull [4]
- Entire connector fits within a compact 1.5 × 2.5 × 1.0 cm footprint.
- Fully user-solderless design requiring no special tools.
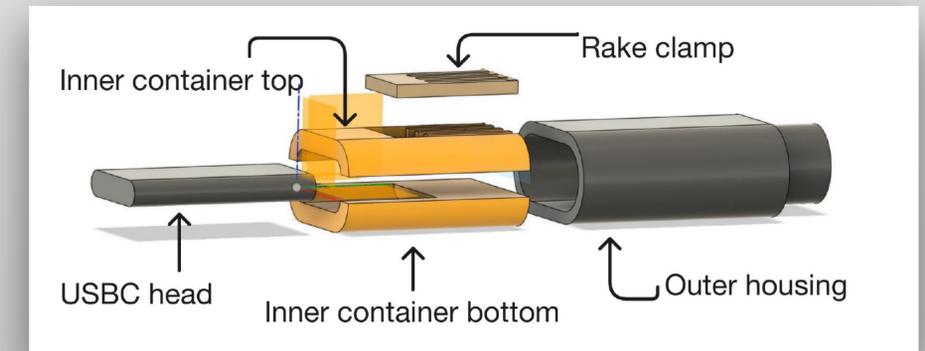- Internal wiring system allows for easy connectivity without sacrificing integrity.

Table 2.
Possible risks of using the MDCS Connector in relation to its impact and likelihood of happening

Risk	Mitigation plan (if risk level is 2 or above)	Risk Level
Overheating of MDCS Connector (melting housing or just poor power transfer)	N/A	1
Fire hazard from a poor connection sparking	Ensure tight connection and avoid exposed wire	2
Hazard from accidental water spill	Avoid liquids near technology, turn off power, and do not touch wet connector	2

Figure 6. Physical Working Prototype
Pictured above is the physical working prototype of the MDCS Connector, with its primary function being transferring power.

Figure 7. Exploded View of the USB-C Connector Housing Assembly
Exploded view showing the USBC head, two-piece inner container, rake clamp, and outer housing. Each component aligns to secure the connector, route wires, and provide structural support.

Conclusion

Our next steps include sizing the prototype to a practical scale that can interface with multiple header types in addition to USB-C.

With the correct headers integrated, we will also implement bidirectional data-transfer functionality between devices.

References

[1] V. Forti et al., "The Global E-waste Monitor 2020," United Nations University, ITU, and ISWA, 2020. [Online]. Available: https://ewastemonitor.info
[2] I. A. Radušin, D. Duraković, A. D. Djeić, and V. Marković, "Recycling of electrical cables—Current challenges and future prospects," International Journal of Environmental Research and Public Health, vol. 20, no. 19, p. 6755, 2023. [Online]. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10608251/
[3] USB Implementers Forum, "USB Type-C® Cable and Connector Specification, Revision 2.1," USB-IF, 2021. [Online]. Available: https://usb.org/document-library/usb-type-cr-cable-and-connector-specification-release-21
[4] Neutrik AG, "NTP10 MediaCON USB-C Cable Datasheet," Dec. 2018. [Online]. Available: https://www.mouser.com/datasheet/2/289/Neutrik_12142018_NTP10_-_mediaCON_USB_C_Cable-1510317.pdf
[5] UL Standards, "UL 486A-486B: Wire Connectors," Underwriters Laboratories, 2020. [Online]. Available: https://standardscatalog.ul.com