

L3Harris Communications Learning Pod (CLP)

Project Description

L3Harris desires a simple, plug-and-play educational tool, named the Communications Learning Pod (CLP), to explain how communications systems function. The purpose of this Capstone project is to interactively simulate how inputs travel through datalinks until the end user receives the inputs.

Main Requirements & Constraints:

- Simulate a datalink communications process from transmission to reception
- Allow multiple people to exercise the system simultaneously
- Be robust and able to endure frequent handling and usage
- Easy to handle and require minimal maintenance
- Provide a cohesive, engaging, and educational experience that leads to high retention

Design Description



The CLP system simulates a Mars rescue mission with two teams: Earth-based mission control and stranded astronauts on Mars. The Earth team creates the transmission side of a datalink while the Mars team creates the reception side. Both teams must work together to establish a full datalink so the Earth team can send a message to the Mars team. The user interface teaches users about the communications process. The users use this knowledge to create a datalink by inserting 3D printed keys with near field communication (NFC) tags into slots with NFC readers and testing them by pressing the push-button located on each box. Incorrect key placement prompts users to retry. Successful arrangement of the keys allows the users to complete the mission prompts and create a full datalink.

Performance Review

Requirement/Constraint	Unit	Threshold per Box	Target per Box	Predicted Performance per Box	Actual Performance per Box
Product volume	ft ³	3.2	1.6	1.59	1.59
Product weight	lbf	50	30	15.87	21
Time to setup/pack product	mm:ss	10	5	1:36	2:45
Task completion time	mm:ss	15	10	5:22	13:17
Post-assessment scores	%	70	100	83.3	82.5
Number of ways to arrange communications process	<i>n</i>	1	12*(!)	10*(!)	12*(!)
Number of required user inputs	<i>n</i>	2	4	4	4
Number of keyboard commands	<i>n</i>	3	8	6	8
Number of desktop shortcuts	<i>n</i>	1	3	3	3
Vertical force to detach wood attach blocks from Pelican case	lbf	15	21	20	≥ 28
Average Raspberry Pi CPU temperature over first 20 min of operation	°C	80	55	60	52

Conclusion

Performance: The CLP system fulfills each requirement and constraint identified by the customer. The indicating factor determining the success of the CLP is a retention quiz completed after the user experience. The average score on the retention quiz, regardless of CLP box, is 82.5%. This indicates users became proficient in communications terminology and mechanics.

Lessons Learned: We discovered the importance of prototyping early and adapting to numerous revisions and setbacks. Furthermore, we learned how to communicate and assign tasks as a team, manage customer expectations, and lead in our respective areas of expertise. We gained extensive knowledge in 3D printing, coding, and translating complex topics into simpler terms.

Recommended Future Work: We recommend creating additional user interfaces tailored to different age groups to allow users to learn at their age level. In addition, we recommend tapering the keys to limit interference with the slots and reduce contact noise. We also recommend improving the communication method between the CLP boxes. Bluetooth communication currently transmits the message from the Earth CLP to the Mars CLP but is not always reliable, causing a message backlog.