TECHNICAL INVENTORY MANAGEMENT
FOR COLLEGE OF LIBERAL ARTS

A Senior Project submitted to

the Faculty of California Polytechnic State University,

San Luis Obispo

In Partial Fulfillment

of the Requirements for the Degree of

Bachelor of Science in Industrial Engineering

by

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Abstract

This project is sponsored by California Polytechnic State University's Information Technology Services (ITS) department aimed to help with the transfer of inventory management from ITS to the College of Liberal Arts' departments. Currently, there are no guidelines on how equipment is handled and little to no information about the flow of equipment. This creates difficulty for faculty and staff within those departments to check out, look up, or keep track of equipment. The sponsor needs for each department to be responsible for their own equipment and to familiarize themselves with the old database system the ITS used.

After understanding the current state and understanding the database system, the team worked on drafting potential solutions based on hierarchical positions within the department and how much responsibility each level should have. Looking at the criteria-weight matrix, one solution outperformed the others.

To implement that solution, the team worked together with ITS to create user accounts for the equipment database and hold meetings with department Administrative Support Coordinators (ASCs) to onboard them. The team then introduced the ASCs to the guides on how to perform specific tasks hosted on California Polytechnic State University's Wiki.

Acknowledgements

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1. Introduction and Background

The College of Liberal Arts Tech Services team oversees many types of electronics that are used by the departments within the college. The CLA Tech team also has a database that lists all that equipment, including the equipment type, owner, location, where it was last seen, and when it was last maintained. The database includes about 3,000 items.

As of this year, the CLA Tech Services is merging with the Information Technology Services (ITS) and will no longer be able to handle the CLA equipment as meticulously as before. Thus, CLA Tech Services is interested in involving the Administrative Support Coordinators (ASCs) of each department to handle their respective equipment.

Unfortunately, the CLA has hired many new ASC who have never had the experience of using the database and who would not know where all the departmental equipment is. The CLA Tech Services wants these new ASCs to learn about locations and owners of the inventory, so that they can update the database at least once a year about each unit's location and whenever necessary adjust database information (primary use case for an office move). Only in the case of malfunction or other problem with the equipment should the CLA Tech Services be contacted. This will lead to less workload for the CLA Tech Services (who will now become ITS) and a better record-keeping database for each department within CLA.

2. Problem Description

There is a financial gap between inventory on paper and actual inventory. Since inventory control is not consistent, the likelihood of shrinkage is high, due to both misplacement and theft. Time is wasted as a result of additional inventory walkthroughs to check inventory data. There are many instances of incomplete movement process, discrepancy in electronic and physical data on location of the equipment. The filling-out Off-Campus Use Form is inconsistent, therefore the location of equipment is uncertain. Some departments within CLA use their own equipment database which does not always align with the main CLA one, leading to even more discrepancies.

List of causes:

- People do not meet the yearly completion date of September 1st

- Low confidence in completing the check because of many new ASCs (14 of 23 ASCs are new hires)

- There is no complete guide on what to do

    o People fail to perform their part

    o Inconsistencies

- Poor tracking of equipment

    o Errors in inputs

    o Forgetting to change data if an item moves or changes owner

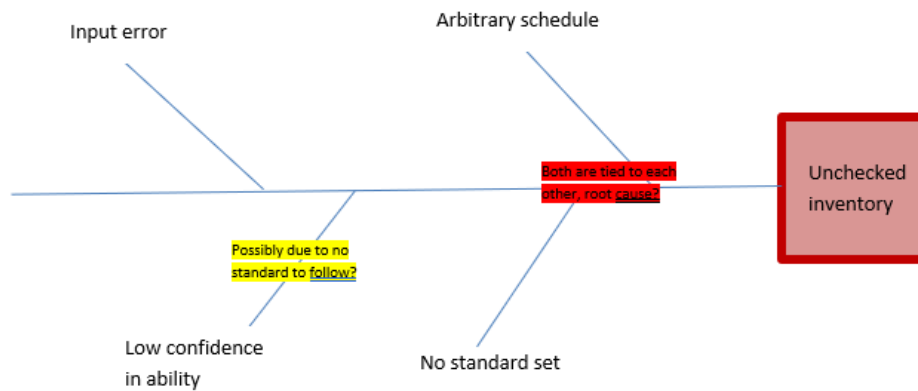   o Uncompleted checks due to the COVID-19 pandemic

Figure 1: Root Cause Analysis

Metrics

Metric	Current State	Solution State
Schedule	People do not meet the yearly completion date of September 1st	Each department within CLA will have a set time period to run their inventory checks.
Checking Flow	Whichever room or department the tech has access to; by availability.	A most optimal flow will be established that can be reused for future checks.

|		
Repeatability	Every ASC has their own method for their department.	Establish one consistent way to enter and maintain data in the database.
Comprehensibility	There are many new ASCs that don't understand the system and don't always ask for help.	Create guides and teach the ASCs how to handle data and what each section of the database means. Make sure if ASCs are unsure of what to do, they know where to find guides and who to call for help.

Table 1: Project Metrics

Examples
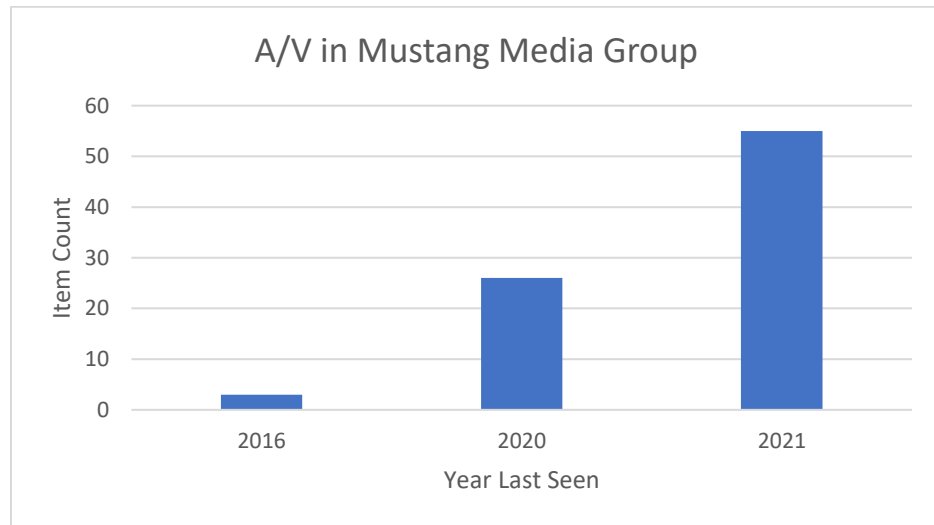
Figure 2: All video and audio equipment belonging to Mustang Media Group and the last year it was seen
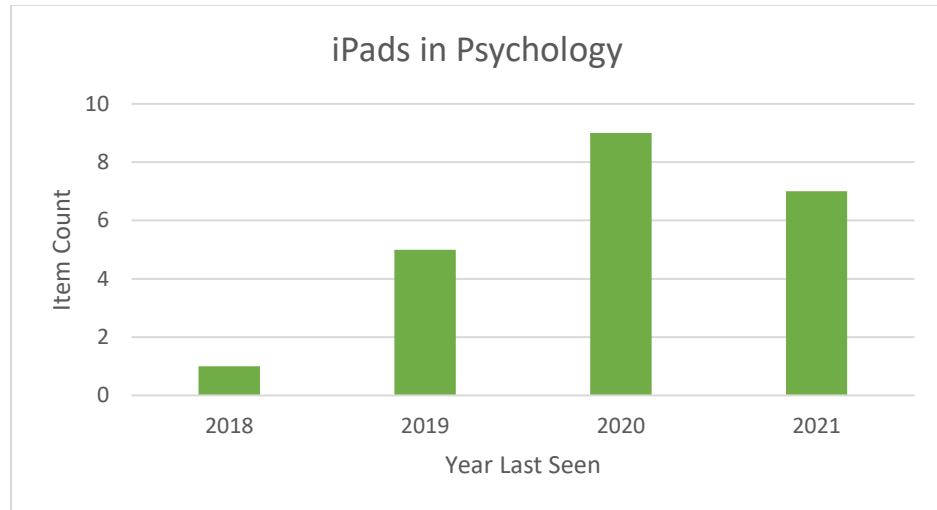
Figure 3: All iPads belonging to Psychology and the last year they were seen

3. Literature Review

The CLA tech database has a higher number of discrepancies and out-dated data than preferred. This includes incorrect database entries and physical location of the equipment. However, most of the staff whose duties include check-ups and corrections made to the database are newly hired. Thus, they are not familiar with the database and don't know much about the equipment. The additional research was to investigate the optimal layouts, general inaccuracies in inventory management, ways of making instructional guides, and how to collect feedback for improvement. The ten articles were collected through Cal Poly's OneSearch, a shared library software platform that is run by the CSU libraries. The scope of this project will be limited to focusing on incomplete data by creating guides and convenient layouts to assist ASCs in learning their duties in respect to the department-owned equipment. Further research into this will be focused on examining different guides used in various corporate diction.

In the conclusion of Jian (2020), it is said that text-diagram instruction showed the best reading comprehension. This supports the idea that text and illustration should be used together to provide the most comprehensive instruction. This can also be used to analyse prior guides made by CLA tech.

From the Atlassian website maintained by Cal Poly, there is a webpage guide used by the school's College of Business to perform a variety of tech tasks. It is built to show a layout of hyperlinks leading the user to

different topics, where the webpage will give detailed instructions with images on how to complete a task. This is going to be used as the primary template for the manuals to be utilized by the ASCs within CLA.

As said in DeHoratius and Mersereau (2008), there are three ways one can respond to inaccuracies in inventory: prevention, correction, and integration. Although the focus may only focus on one of the ways, these can be worked with in tandem and interchangeably. The article chooses to focus on the third way of integration, but the CLA inventory project would rather benefit from prevention since after being divided into different departments, the inventory is not vast enough to not consider this an option.

From the DeHoratius's Inventory Record Inaccuracy: An Empirical Analysis, it is said that inventory inaccuracies can come from database errors, incomplete data, restocking errors, and employee theft. To work in the scope of the project, the focus will be on limiting incomplete data and database errors.

Additional information and inspiration was gathered from the Cal Poly Wiki page.

4. Solution Design

Deliverables

- Guides for checking physical inventory for each department in a language that can be understood by all ASCs.

- Creating a flow and a schedule for each department check so the Dean's Office can help coordinate inventory and assist in any problems arising. Thus, creating in up-to-date information within the college.
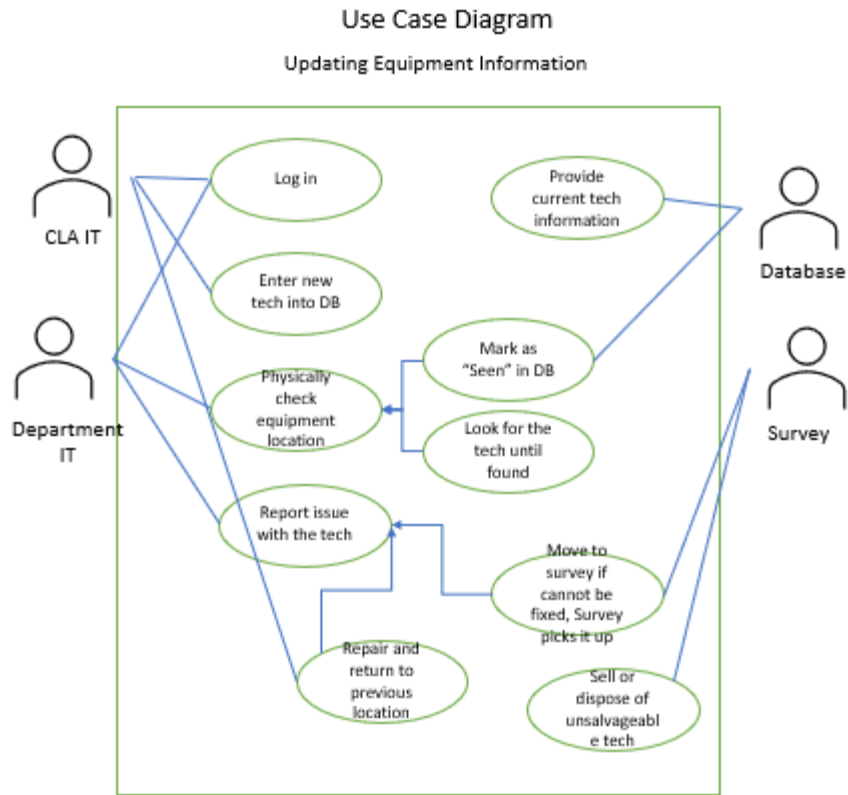
Use Case Diagram

Use Case Diagram

Updating Equipment Information

Figure 4: The use case diagram for the updating equipment information system

Trade-Off Analysis

The three alternative options to complete the checkout process would be the following: the first would involve the user contacting the CLA tech office and have them set up a device for them, the second where the user will contact their department ASC who in turn will reach out to the tech office, and third where the user will contact their department ASC who will contact the college's dean's office (DO) and only then the tech office will be contacted.

The criteria considered will be the following: time it takes to checkout equipment, reliability to return the equipment back to the department, how fast technical problems can be spotted in the device, how well the information about equipment disposition is kept up to date, and overall convenience of the process for the user.

Options	Criteria (weight)	Total

	Time (10)	Return (10)	Technical Assistance (8)	Up To Date (6)	Convenience (6)	
1	Within few hours (10)	Often no-response emails (4)	Inconvenient to drop by the tech office (5)	Immediate update (10)	Requires filling out forms and often confused by the process (5)	270
2	1-2 days (7)	Direct contact from department gets quicker response (8)	Almost daily contact with the department ASC, more opportunities to mention it (9)	ASCs sometimes forget, but still mostly reliable (8)	A familiar ASC is easier to approach and have more opportunities to answer questions (10)	330
3	A week (3)	Quicker response because of the DO (10)	Same as option 2 (9)	Both DO and ASCs see the device, thus a higher chance of update (9)	Same as option 2 (10)	316

Table 2: Criteria-weight matrix

In conclusion, the best option is 2 with just the ASCs handling the checkout process. Although there are many benefits with involving the DO in the checkout, it ultimately slows the process down and it would be more beneficial to deal with the DO during the audit period. Having the CLA tech team handling the checkouts was not the norm and based on the observations of the criteria stated previously, it is not the most optimal use of the CLA tech resources. Instead, the department ASCs should be trained to use the same database to resume checkouts.

5. Test and Evaluation of Design Alternatives

System Level Requirements – Verification and Validation

System level requirements	Justification	Verification	Validation
The database shall have up-to-date information.	For easy tracking and awareness of the device's location. *	Inspection of items in database through list of departments. *	During physical checks, additionally check equipment information (Make, Model, SN, etc).
All CLA devices shall have an owner identified.	*See above.	*See above.	During physical checks, checkout process, or technical assistance, check the database and if needed, update the user.
All CLA devices shall have been confirmed in use within last 12 months.	*See above.	List department items in the database by date last seen and confirm all items were seen in the last 12 months.	Going down the list of items, inquire and find the items in order to update their seen date.
Technical services shall be made aware every time there is damage to CLA device.	To provide immediate assistance and to reduce backlog of service work. *	Send out notices of upcoming checks. *	Receive emails back talking about damages and if the equipment is checked and damages are noticed, ask the user to notify the services as soon as possible next time. *
Users shall inform the technical services of any damages to the device immediately.	*See above.	*See above.	*See above.
Users shall use CLA devices with little difficulty.	For user satisfaction and less calls to the CLA tech offices.	Provide CLA tech links and helpful guides. *	See how many people use them via meetings. *

The CLA website shall provide guides and instructions for its devices.	To make the usage of devices as simple as possible.	*See above.	*See above.
Users shall follow usage protocol as laid out by the CLA tech team.	All users must be made aware that they are using a state device and are not allowed to download or use non-school-approved files.	Create a notification system when a device in the network downloads a non-whitelist item.	Catch non-compliant devices early and inform the user of the policy.
Technical services shall log out of all admin accounts.	Admin accounts have power to alter important components of a device and could be used to affect other things in the network.	*See above.	*See above.
Technical services shall have weekly meetings to look over progress and goals.	Define scope and responsibilities within the team.	Determine the best time for a short meeting and use a file management system to create team goals.	Ask for feedback from the team members and observe the work efficiency from the pre-made goals.

Table 3: The verification and validation plan made from the system level requirements

Risk Matrix

List of Potential Risks

- Technology failures (A)

- Overwhelming scope (B)

- Unrealistic schedule adjustments (C)

- User interface shortfalls (D)

- High expectations of performance (E)

Severity		Highly Unlikely	Unlikely	Possible	Likely	Very Likely
	Extensive					
	Major				C	
	Medium				C	E
	Minor		A/B	A/D	D	
	No Impact					
				Probability		

Table 4: Risk matrix

Proposed Risk Mitigation:

- Technology failures (A)

  - Make sure to follow-through, don't leave process halfway through in case of technical failure, move all software and hardware to the newest possible.

- Overwhelming scope (B)

  - Conduct check-ins between the team about progress, don't unnecessarily expand work.

- Unrealistic schedule adjustments (C)

  - Insert the schedule responsibility in a gap the user might have in their workflow.

- User interface shortfalls (D)

  - Create guides for the database system. Make sure most possible questions can be answered by that guide. Run tests and adjust guides as necessary.

- High expectations of performance (E)

  - Same as D, potentially walkthrough with the user so they may be able to copy you.

6. Final Design

As seen in Table 2, the solution moving forwards was the second, in which the ASCs handle checking out equipment for the faculty within their own department. The ITS should only be involved in the process if there is a technical problem with the devices.

To implement this process would require the ASCs to have the ability to look up the equipment their department has and what can be checked out to the faculty. The implementation plan had the following four points:

- Onboard
  - Get each user a working account on the database
- Access
  - Get each user access to guides to use the system
- Collect
  - Make a list of items that need to be revamped moving forward
- Inquiry
  - Give each user an outlet to ask for help and ask questions

After equipping each ASCs with an account, they now have the ability to perform all tasks as shown in the criteria-weight matrix.

7. Further Design

In the future, all ASCs will have a working user account on the CLA database. As part of the meetings with the ASCs, there was a lot of qualitative data collected based on the user experience. This information was passed on to the current ITS members, who are responsible for revamping the database to be more user-friendly, including making it more accessible via other internet browsers (i.e., Firefox, Chrome) and more versatile inputs into search fields. The current database system is already ADA compliant but it will be expanded upon. This is part of an ongoing project which will continue for many more months.

8. Conclusion

This report's purpose is to show the efforts of the team and ITS into onboarding the ASCs into inventory management to have more up-to-date information and more accountability. Most helpful research for this project was provided by the ITS members who were originally on the CLA Tech team and the Wiki page that included inspirations for the guides.

Part of this project was making the ASCs more aware of the system that has existed prior to many of them starting their position and giving them access to it, instead of keeping track of their department equipment through paper or not all. This will also have all equipment in one location that will be accessible for everyone involved in the inventory management.

Next step for this project is to transfer all ASCs that were a part of this process onto the new database that is currently in development and creating a more accurate representation of the equipment within each CLA department.

9. References

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https://doi.org/10.1371/journal.pone.0231350

Appendix

List of guides and database images.

In the User account, they need to go through a 2 step process.

    1. When they launch the Tobii short cut it comes up with the screen below.. They need to change the Domain to be CALPOLY, or it will not work.
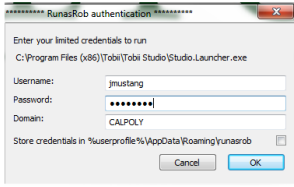
    2. They will need to activate the license as it is on the info in the PDF left on the desktop of the machine
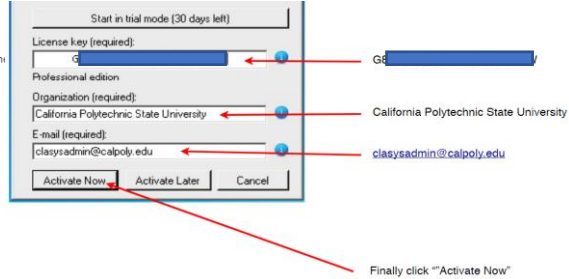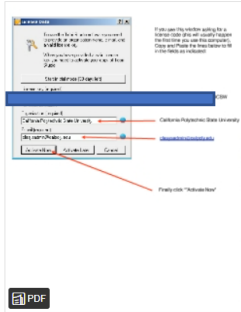
Inspiration: Gathered from wiki.calpoly.edu. Images can be embedded for finer details.

Department	Name	Bld	Room	FWPyr	FWPmd	Type	Model/Description	Disposition	CPID	Last Seen
Ethnic Studies	Isom, Denise	038	136B	2016	H2	CPU	MacBook Pro, 13.3" (Ret. L	XFer	134192	2020-03-03 08
Ethnic Studies	Yeh, Grace	047	33B	2018	F	CPU	iMac 21.5" (Ret 4K, 2017)	In Use	118659	2020-10-28 09
Ethnic Studies	Lamoree, Lizzie	038	110	2017	H	CPU	MacBook Pro, 13" (2017, 2	In Use	134267	2020-11-23 10
Ethnic Studies	Pulitano, Elvira	038	139	2006		LPrinter	LaserJet 1020	In Use	9999274	2021-01-26 14
Ethnic Studies	Navarro, José	038	140	2019	F	CPU	iMac 21.5" (Ret 4K, 2019)	In Use	118913	2021-01-26 14
Ethnic Studies	Navarro, José	038	140	2007		LPrinter	LJ 1022	In Use	9999454	2021-01-26 14
Ethnic Studies	Yeh, Grace	038	110	2007		LPrinter	LJ 1022	In Use	9999458	2021-01-26 14
Ethnic Studies	Navarro, Jenell	038	136B	2018	F	CPU	iMac 21.5" (Ret 4K, 2017)	In Use	118658	2021-01-26 14
Ethnic Studies	Navarro, Jenell	038	111	2009		LPrinter	Laserjet 1022nw	In Use	9999248	2021-01-26 14
Ethnic Studies	Razi, Alpen	038	106	2006		LPrinter	Laserjet 1020	In Use	9999725	2021-01-26 14
Ethnic Studies	Isom, Denise	038	136	2015		RPrinter	Color LaserJet M553dn	In Use	203451	2021-04-21 13

An example of a database list for ethnic studies.

Name of the staff member

Department within CLA (e.g. History, Journalism)

Office location (use format Bld: 47, Room: 12A)

An example of input criteria for Faculty/Staff search.

An example of the resulting page after the input of the Name field.