Barcode Enhanced Inventory Management System

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IE 4466 SENIOR DESIGN

Introduction

- Inventory management systems of the maintenance departments in El Paso, Texas, have been left out of normal operating procedures that happen in the main operating floor. The loss of accountability and recorded history of parts and repairs makes the maintenance department lose out on time and capital.
- Tracking the incoming order of parts and outgoings to be used by maintenance personnel using barcodes on each spare part to scan and receive information regarding that part makes for accurate accountability of every machine repair on the plant floor.

Concept of Operations

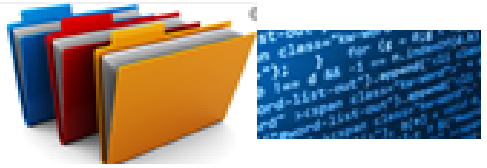
Management

- Part Information
- Data management
- Inventory control

Start

Data/Software

- Barcode-generating algorithm
- Database interface software
- Part specification data
- Inventory data



Hardware

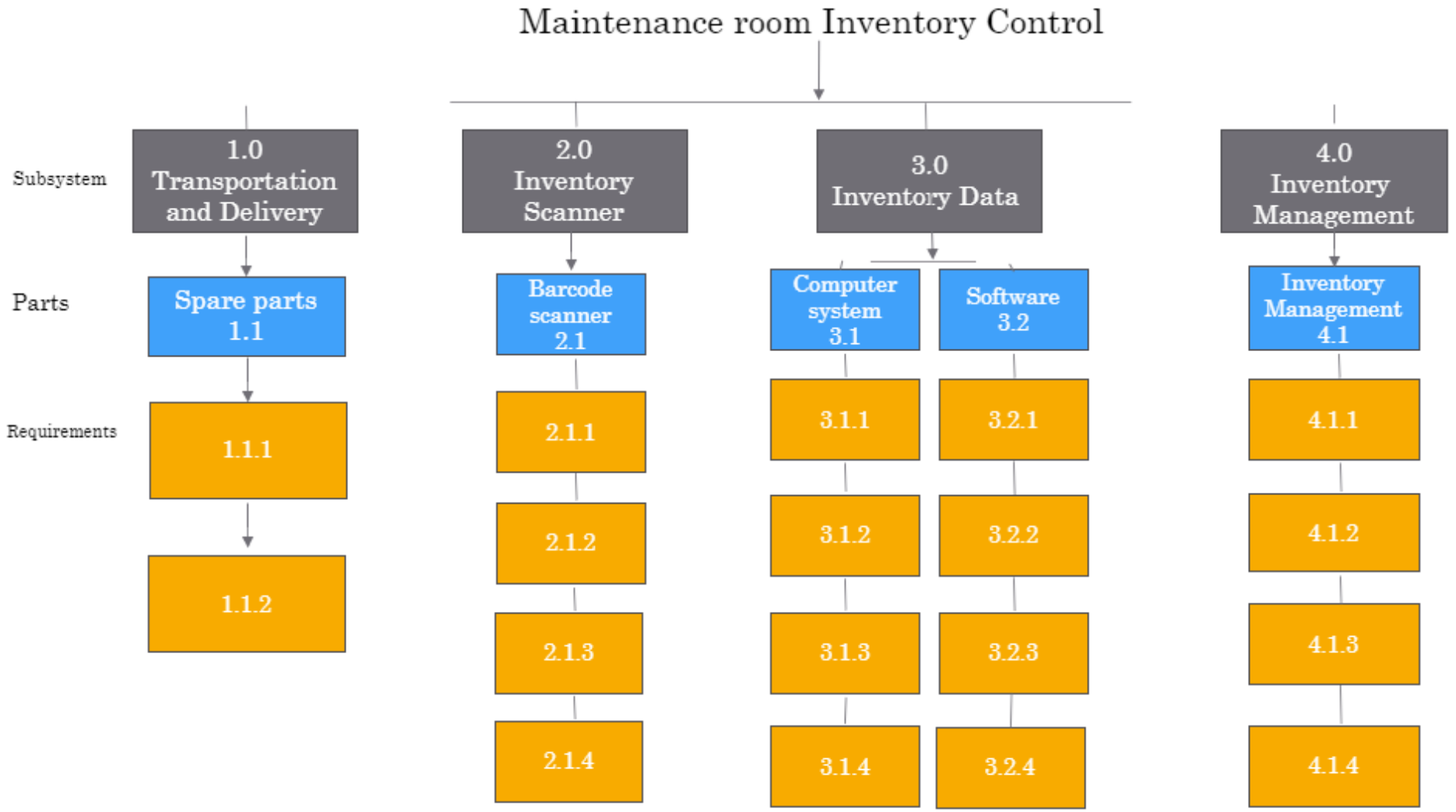
- Barcode scanner
- Computers
- Barcodes

Parts

End

- Parts are ordered depending on stock levels
- Parts should be scanned as they enter and leave the system

System Decomposition and Requirements



System Requirements

Spare parts

- 1.1.2 - Spare Parts shall be available in parts room when break down occur and needed for machine repairs.

Barcode scanner

- 2.1.1 - Parts shall have barcode to read identification number.
- 2.1.2 - Barcode reader shall have data decoding capability.

Software

- 3.2.1 - Software shall record the input/output information of the barcode reader.
- 3.2.3 - Software shall generate a unique identification bar code number for part inventory.

System requirements

- 3.2.4 - Software shall notify the user when stock levels drop below one spare part available in part room.

Inventory management

- 4.1.2 - Inventory shall use forecast inventory to calculate demand.

Requirements Validation and Verification Plan

Requirement ID	Reqmt Title	Requirement	Requirement Validation	I	A	T	D	Verification Plan	Verification Data
2.1.1	**Barcode Assigment**	Parts shall have barcode to read identification number.	Based on identification criteria of each part to identify and aquire the needed part to repair.	X				Will inspect that every part located in the storage facility has an assigned barcode visible and accessible for an employee to scan.	Barcode needs to be clearly visible with no obstuction when doing inspection. Example---Barcodes need to be near the nameplate of the part but not obstructiong the nameplate itself.
2.1.2	**Barcode Capabilities**	Barcode reader shall have data decoding capability.	Ex. Barcode is read from the part and data will produce information regarding name, specifications and quantity of parts available.				X	1-Generate a dummy barcode with all information fields filled. 2-Read the barcode and check if the output information is the same as the input	Read requirment ID 3.2.3 To find out how the barcode will be generated. --- Information will be filled out in software containing the barcode numbers and information about that barcode number containing name, specifications and quantity of parts available. Scanning the barcode will bring this information on computer screen. Verification of what the part is and data displayed on screen.
3.2.1	**Data Recording**	Software shall record the input/output information of the barcode reader.	Data from the barcode is read and decoded to supply part information to software inventory managment system for history of part.	X				1- Register a dummy part 2-Check if dummy part is in maintenance database 3-Check if dummy part got registered in the company system	The code scaned from the barcode scaner should effectively be translated into data such as name of part, status of part, and quantity of similar parts available and be displayed on the computer system.

Requirements Validation and Verification Plan

Requirement ID	Reqmt Title	Requirement	Requirement Validation	I	A	T	D	Verification Plan	Verification Data
3.2.3	**Inventory ID**	Software shall generate a unique identintification bar code number for part inventory.	For the high variation of different spare parts in use in the plant floor, the unique identification bar codes will be inplace to group and identify the part needed for repair.			X		Will test that bar codes generated by the software are unique and assigned to individual inventory.	Barcode will follow the UPC-A standard retail barcode used in United States. Strictly numeric from 0-9. Containing 12 digits with start, middled, and stop symbols. First number is the type(plant floor machine identified number) Being numbers 0,2,3 and 5. The next 5 numbers is the identification number form the manufacturers of the part. The next 5 numbers is the stakeholders chosen identification number set. The last number is the modulo check number to detect errors in transcription of the barcode. This creates unique numbers that will not duplicate based on the high variability of parts.
Requirement ID	Reqmt Title	Requirement	Requirement Validation	I	A	T	D	Verification Plan	Verification Data
3.2.4	**Low Stock Notification**	Software shall notify the user when stock levels drop below one spare part available in part room.	Automatic Systems alerts will let managers know when the part reaches less than one spare part available for use.		X			1-User sets the parameters for the low stock notification for a dummy barcode 2- Dummy barcode is scanned for checkout n-times, simulating that the part is being removed from maintenance room for usage. 3-After the stock levels go beyond the established parameters, check the email that was registered for the notification, in this case, the maintenance manager's email	Preventive maintenance would reduce the inventory size, where many spare parts will be ordered to come just before of the maintenance time with a safety period. It will also reduce the minimum no. of parts nventories, where preventive maintenance reduces the risk of unplanned breakdowns.
Requirement ID	Reqmt Title	Requirement	Requirement Validation	I	A	T	D	Verification Plan	Verification Data
4.1.2	**Inventory Forecasting**	Inventory shall be used forecast inventory to calculate demand.	Software manipulates the data to calculate forecast and locate the amount of inventory levels needed in the parts room.				X	Will demonstrate that by using forecast based on the manufacturer's previous selling quantities, it can be determine an estimate quantity of parts that will satisfy the next demand.	The usage of forecasting formulas such as the Moving Average and Exponential Smoothing formula, depending on the company situation, can be used to calculate the demand for the future.

Subsystem and Part Design

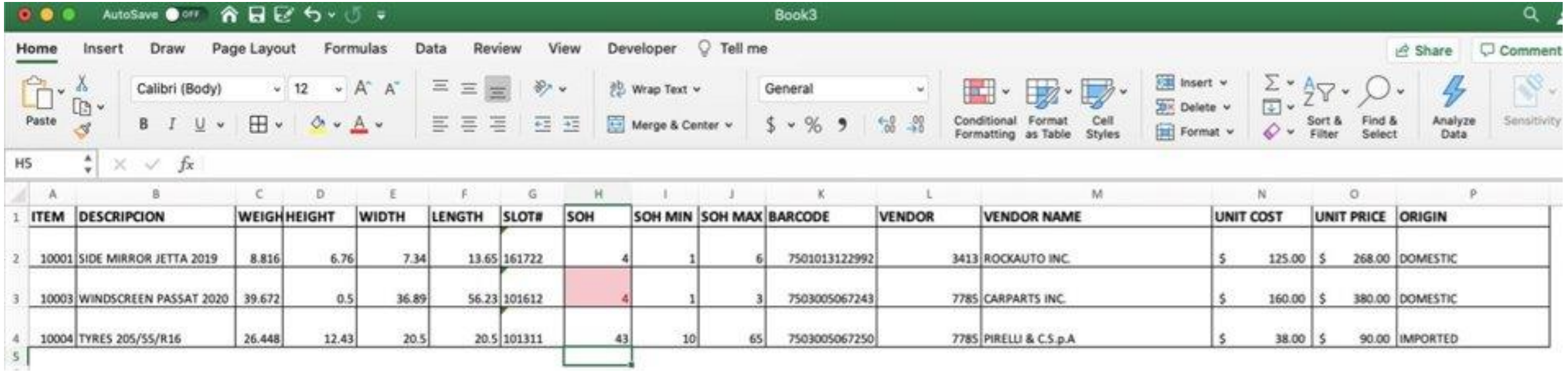
Barcode Scanner

- Barcode used will follow the UPC-A standard retail barcode used in United States.
- Barcodes will be generated and assigned to inventory, each with a unique identification number.

Subsystem and Part Design

Software

- Data scanned will be recorded and organized into a computer software.
- When scanning or manually searching a part, the software will recognize the information and display it to the user.



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ITEM	DESCRIPCION	WEIGH	HEIGHT	WIDTH	LENGTH	SLOT#	SOH	SOH MIN	SOH MAX	BARCODE	VENDOR	VENDOR NAME	UNIT COST	UNIT PRICE	ORIGIN
10001	SIDE MIRROR JETTA 2019	8.816	6.76	7.34	13.65	161722	4	1	6	7501013122992	3413	ROCKAUTO INC.	$ 125.00	$ 268.00	DOMESTIC
10003	WINDSCREEN PASSAT 2020	39.672	0.5	36.89	56.23	101612	4	1	3	7503005067243	7785	CARPARTS INC.	$ 160.00	$ 380.00	DOMESTIC
10004	TYRES 205/55/R16	26.448	12.43	20.5	20.5	101311	43	10	65	7503005067250	7785	PIRELLI & C.S.p.A	$ 38.00	$ 90.00	IMPORTED

Subsystem and Part Design

Inventory Management

- Inventory Manager is tasked to periodically inspect the current data to find errors and update outdated data.
- Inventory Manager will use forecasting methods such as the Moving Average Formula or the Exponential smoothing formula to calculate future demand.

Recomposing Parts into Final System

- The overall system design review is done based on the verifications and validations of the requirements gained from the stakeholders' specifications. Getting into the point of view from the mechanics and managers using the system greatly improved our design process when figuring out ways to verify the design was implemented the right way. Anywhere from the scanning and computer in the maintenance part room to the data saved in the software all the way to management making orders of parts to have the correct inventory levels in the parts room to cover the need and supply. Each subsystem impacts the others success or failure.

- From our previously stated requirements, there is a need to define the actions of every single one of them. By doing so, we are saying to our stakeholders that the current requirements are being fulfilled in the best way possible from an engineering point of view. Once our requirements were set, we began focusing on to the smaller details to create our verification data. From setting up inventory quantity limits in the storage facility, to explaining simple tasks that our barcode scanners are used for, the verification data gives useful insight regarding the nature of our requirements.

OVERALL SYSTEMS DESIGN PROCESS VERIFICATION

- SPARE PARTS HANDLING VERIFICATIONS
- INVENTORY SCANNING VERIFICATIONS
- INVENTORY DATA VERIFICATIONS
- INVENTORY MANAGEMENT VERIFICATION

Validating Overall System

- Although what is stated trough out the verification process provides the evidence that it will fulfil our stated requirements, there is no guarantee that it will meet their specific characteristics. That is what our Validation Process is for.
- We managed to validate our system by conducting different method on each requirement. From conducting visual checks on most of the process to manually calculating forecasted demands using available inventory samples to ensure that the methods were accurate, we verified each requirement to ensure that we obtain results closed to our expectations

VALIDATION
SPARE PARTS HANDLING VALIDATIONS
INVENTORY SCANNING VALIDATIONS
INVENTORY DATA VALIDATIONS
INVENTORY MANAGEMENT VALIDATIONS
SYSTEM VALIDATION METHODS

Questions?

THANK YOU