

Project Overview

PSI Control Solutions needs a system to maintain "shop parts" including nuts, bolts and washers. By redesigning the storage devices, and implementing a process for ordering, receiving and storing, PSI Control Solutions can maximize return on investment, while minimizing chances for stock-outs.

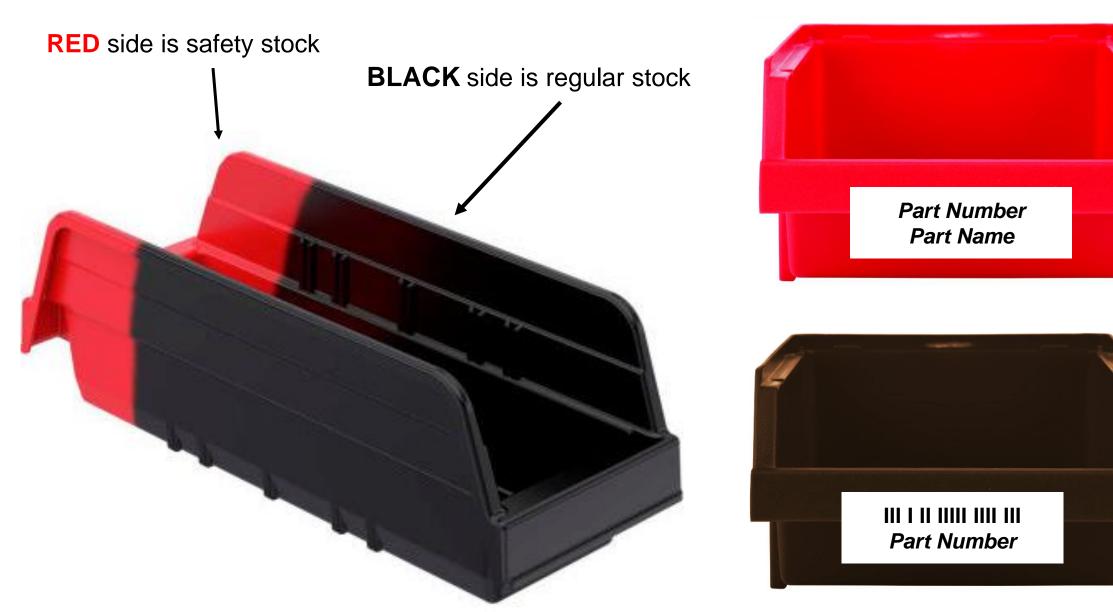


System Criteria and Customer Priority

1. Autonomous	21%
2. Productivity	30%
3. Ease of Use	14.9%
4. Ongoing Cost	12.6%
5. Implementation Timeline	6.3%
6. Implementation Level of	3.2%
Effort	2.9%
7. Initial cost	3.09
8. Scalability	5.4%
9. Data Analytics	

2 Bin KanBan Design

This is designed to signal workers to reorder, while still having parts in stock. This lowers the chances of stock-outs. The workers pull from one bin until it is empty, and then they switch to the second bin while at the same time placing an order to replenish the items in the first bin.



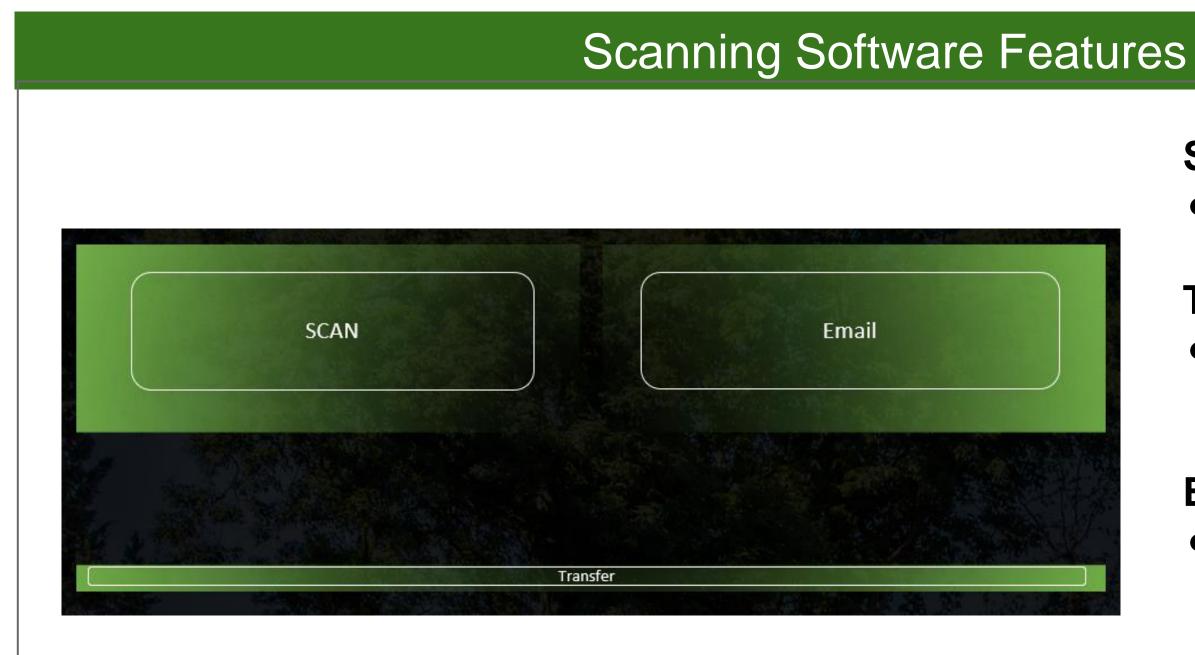
Design for Small Parts Replenishment System Senior Design II - FALL 2021

Anna Pizzano apizzano@uncc.edu, Jefeerson Ashcalla jashcall@uncc.edu, Sam Perry sperry@uncc.edu, Carson Dozier cdozier3@uncc.edu, Majd Alawami malawam2@uncc.edu Mentor: Department of Systems Engineering and Engineering Management, Dr. Churzlu Lim Industry Supporter: PSI Control Solutions, CEO Mark Todd

•	Usages	ated Ex s for sho ties to b	op pa	rts		ReordSafety	· · · · · · · · · · · · · · · · · · ·						
art Number 🔻	Part Name 💌	Part Description 💌	Vendor 🔻	TYPE 🔻	Lead Time 🔻	Average Annual Demand	Average Monthly Dema 🔻	Price 🔻	Order Size 🔻	Reorder Point 💌	Sum Amount 🔻	Sum Qty 💌	Safety S
00000-0098	Fastenal 32392	10-32x3/8" HWSLTCS"F	Fastenal Company - KY	SCREW	3	27510	2293	\$0.08	2500	302	\$4,615.73	55020	76
00000-0241	McMaster 90064A430	10-16 x 1/2" Self-Drilling Screws / Unslotted / Hex Washer Head / Steel / Zinc	Assembly Fasteners, Inc	SCREW	1	27450	2288	\$0.03	5000	127	\$1,454.50	54900	51
00000-0282	McMaster 90675A029	1/4-20 Kep Nut pack of 100	McMaster-Carr	NUT	1	12042.5	1004	\$0.06	1500	67	\$1,354.22	24085	34
00000-0272	McMaster 90279A827	10-32 x 3/8" screw	Fastener	SCREV	3	12010	1001	\$0.02	2500	149	\$426.68	24020	50
00000-0288	McMaster 91102A030	Zinc-Plated Steel Split Lock Washer 5/16" Screw Size, .59" OD, .07" min Thick, fastener superstore \$75.927 Carton of 4,500 pcs	Fastener	WASHER	3	11251	938	\$0.02	2000	141	\$427.88	22502	48
00000-0289	McMaster 91102A031	Zinc-Plated Steel Split Lock Washer, 3/8" Screw Size, 0.385" ID, 0.680" OD, packs of McMaster pk1000	McMaster-Carr	WASHER	1	10502	875	\$0.03	1500	61	\$683.56	21004	32

Order Quantity = (((Sample Mean) + (Normal Distribution Order per size per instance)) / 4)

Sample Mean = Average of the 24 months Normal Distribution prediction = Norm.Inv(0.95, Sample N)EOQ = SQRT([2(Fixed Cost)(Annual Demand)] / holding c Average Order per size per instance = (Total Ordered / Ins



Ordering Proc • Purchase orders are automatically generated after a bin is scanned • Each order is organized by vendor, contact information. • The PO number is created with the date, and number of orders. • Prices, and assigned vendor for each part was determined from historical data

Inventory Control Model

prediction) +	(EOQ) + (Average
---------------	------------------

Mean, Sample STD)
costs)
stances)

	Fastenal 32392	McMaster 90064A430	McMaster 90675A029	McMaster 90279A827	McMaster 91102A030	McMaster 91102A031	McMaster 90276A110
Months	Fastenal Company - KY	Assembly Fasteners, Inc	McMaster-Carr	Fastener Superstore	Fastener Superstore	McMaster-Carr	Fastener Superstore
1	1500.00	6700.00	2010.00	1335.00	1125.25	1.00	833.3
2	1500.00	1914.29	1000.00	1335.00	1125.25	1.00	833.3
3	2000.00	1914.29	1000.00	1335.00	1125.25	3000.00	833.3
4	3500.00	1914.29	2000.00	1335.00	1125.25	750.25	833.3
5	1000.00	1914.29	1000.00	1335.00	1125.25	750.25	833.3
6	2000.00	1914.29	1000.00	800.00	1125.25	750.25	833.3
7	2000.00	1914.29	1005.00	800.00	1125.25	750.25	833.3
8	2000.00	1914.29	1005.00	800.00	1125.25	600.20	833.3
9	3500.00	1914.29	1343.33	800.00	1125.25	600.20	833.3
10	4000.00	1914.29	1343.33	800.00	1125.25	600.20	833.3
11	4000.00	1914.29		800.00			833.0
12	3000.00	1914.29	670.00	800.00	1125.25	600.20	833.0
13	4000.00	1914.29	670.00	800.00	1125.25	1000.00	833.3
14				800.00			833.:
15	2500.00	1914.29	1005.00	800.00	1125.25	1000.00	833.3
16	1000.00	1914.29		1001.25	1125.25		833.3
17		1914.29		1001.25		750.00	833.:
18	2500.00	1914.29					833.:
19	1500.00	1333.33	1000.00	1001.25	1125.25	750.00	833.3
20	500.00	1333.33		1001.25			833.3
21	2000.00	1333.33			1125.25	1000.00	833.:
22	4000.00	1333.33		1001.25	1125.25		833.3
23	1000.00	1333.33	1002.50	1001.25	1125.25	1500.50	833.3
24	3000.00	1333.33	1002.50	1335.00	1125.25	1500.50	833.0
ample STD	1102.31	1039.60	379.16	216.03	0.00	568.06	0.0
ample Mean	2292.50	1968.45	1128.13		1125.25	875.21	833.3
ean Lead Time	3.00			3.00	3.00		3.1
rder Size	4105.64	3678.44	1751.79				
ice	0.08	0.03	0.06	0.02	0.02	0.03	0.
	2091.00	3447.88		3002.45	3077.05	2074.33	4072.
rder Instances	73	5	20	5	8	11	
uantity Ordered	55020	54900			22502	21004	2001
verage order size	754						100
verage of Above Opti	2311	5019	1469	2541	2035	1667	390

Scan

- Allows unlimited amount of barcodes to be scanned Transfer
- Allows for purchase orders to automatically generate given what is scanned.
- Email
- Creates a table of what is scanned, and automatically generates an email ready to send via Outlook

cess	5						
	utions, Inc es Parkway 3269		S & Controls	Phone:	(704) 596-5617	_	
Number:	20211112	Purchase O DATE:	r der 11/12/2021				
NDOR			SHIP TO				
ener Supers Box 854 ners Grove, ilier ID:			PSI Control S 9900 Twin Lak Charlotte NC United States	28269	rlotte		
ange (1		
TNUMBER	PART BAHE McMaster	97 Y 2500	UNIT PRICE	EXT PRICE 44.41			
	McMaster		0.02	38.03			
				-			
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				-			
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				-			
		l 	TOTAL	\$ 82.44	J		
nments or	Special Ir	nstructions			·		
it to: il invoices to		psicontrolsolutions.con	 n 				
	PO Box 22						
	Cornelius, I	NC 28031]				



Volume: 306 in^2

Volume of Cylinder Part x Order Size Recommended <= Bin Volume

Volume	Total Volume	Order size	Order size*Volume	Maximum order size	Bin Size	Bin Volume	%
0.011	0.027	2500	66.931	11430	Large	306.000	22%
0.014	0.034	5000	172.428	8873	Large	306.000	56%
0.014	0.029	1000	28.695	5018	Small	144.000	20%
0.000	0.005	3000	16.099	26835	Small	144.000	11%

- bins.
- volume

An operations manual detailing the system has been drafted for seamless hand-over, and implementation of the proposed system. Contents for the manual include: Introduction, Concept of Operations, Inventory List, Inventory Analysis, Two-Kan-Ban Design, Storage Organization, Wireless Scanner, Ordering, Installing New Part, Setting up Email, Capturing Historical Data, Maintenance, Conclusions and References.





Volume: 288 in^2

Small Volume: 144 in ^2

• The demand at which the individual items are used and part size will determine how many of the items are placed in the

• Assume all parts are cylinder in shape to calculate the

Operations and Implementation

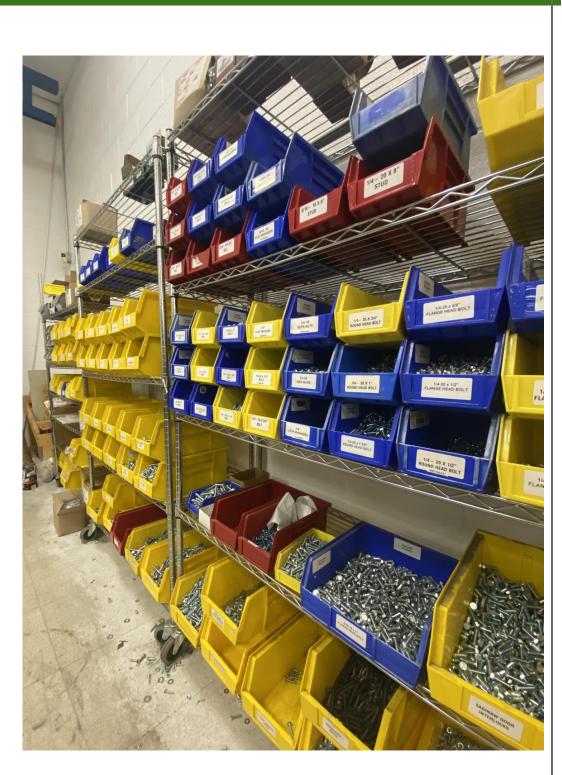
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System

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- 3. Ease of Use
- 4. Ongoing Cost
- 6. Implementation Level of Effort
- 7. Initial cost
- 8. Scalability
- 9. Data Analytics



Project Overview



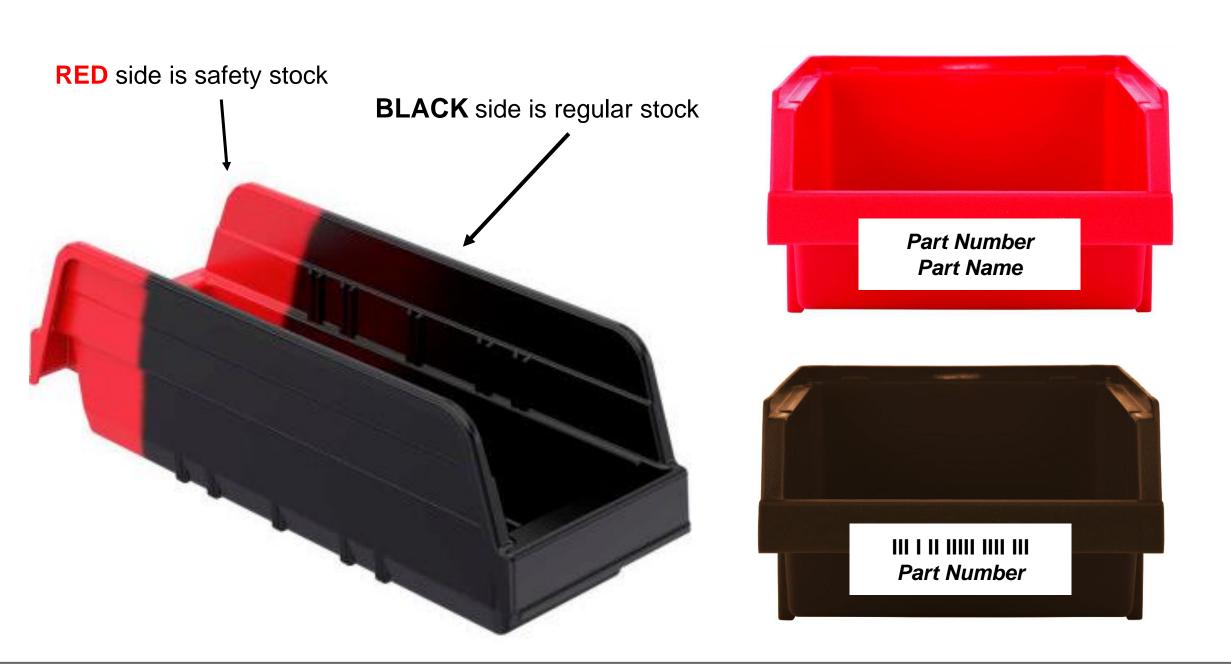


n	Criteria	and	Customer	Priority
				-

5. Implementation Timeline

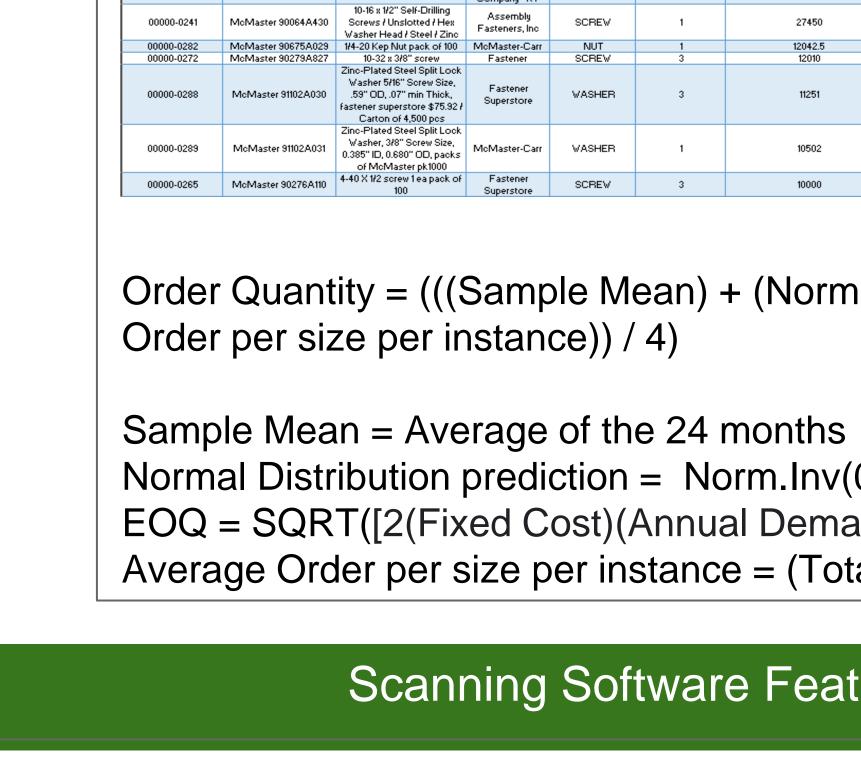
21% 30% 14.9% 12.6% 6.3% 3.2% 2.9% 3.09 5.4%

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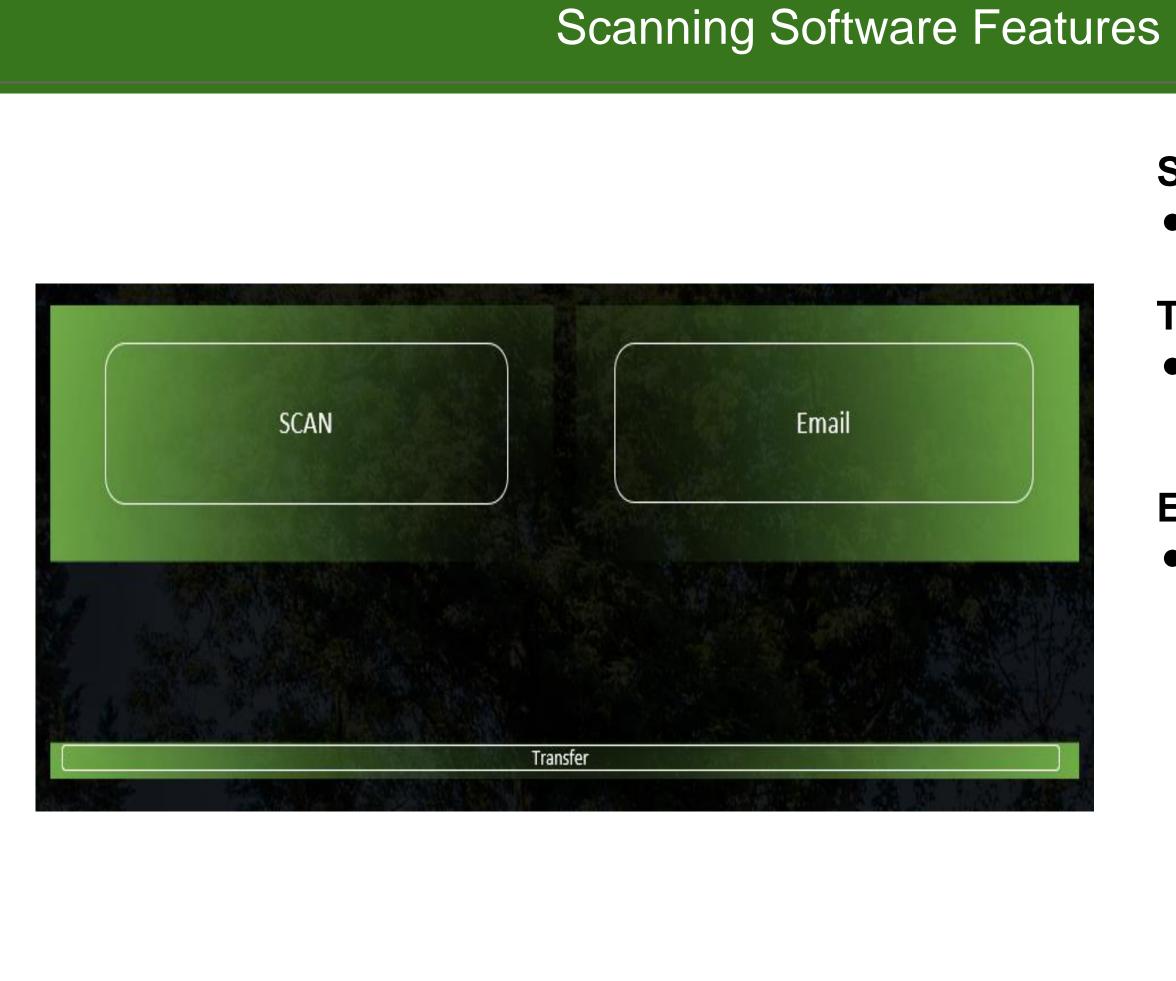




2 Bin KanBan Design



00000-0098



Inventory Control Model

• Automated Excel Sheet • Usages for shop parts

- Reorder noint
- Quantities to be ordered

Reorder point
Safety Stock Levels

Vendor verage Annual Demand -- Average Monthly Dema Fastenal 32392 10-32x3/8" HWSLTCS"F Fastenal Company - KY SCREW 27510 2293 \$0.08 \$4,615.73 3 2500 302 55020 SCREW \$1,454.50 27450 2288 \$0.03 5000 127 1 54900 51 \$1,354.22 \$426.68 \$0.06 \$0.02 12042.5 12010 24085 WASHER 11251 938 \$0.02 2000 \$427.88 141 22502 48 \$0.03 875 1500 \$683.56 21004 10502 61 32 SCREW 3 10000 833 \$0.01 4000 128 \$160.80 20000 46

Order Quantity = (((Sample Mean) + (Normal Distribution prediction) + (EOQ) + (Average

Normal Distribution prediction = Norm.Inv(0.95, Sample Mean, Sample STD) EOQ = SQRT([2(Fixed Cost)(Annual Demand)] / holding costs) Average Order per size per instance = (Total Ordered / Instances)

Scan

 Allows unlimited amount of barcodes to be scanned

Transfer

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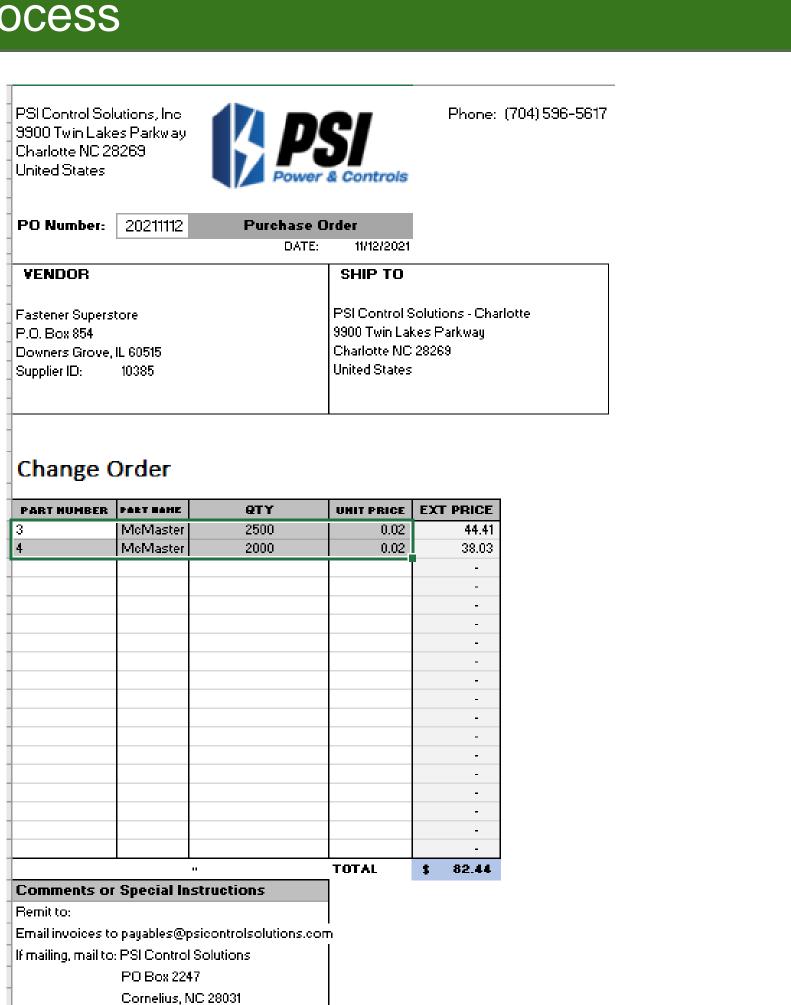
Email

 Creates a table of what is scanned, and automatically generates an email ready to send via Outlook

 Purchase orders are automatically generated after a bin is scanned Each order is organized by vendor, contact information. • The PO number is created with the date, and number of orders. Prices, and assigned vendor for each part was determined from historical data

Company - K.Y Ins Company - K.Y Ins 1 1500.00 6700.00 2010.00 1335.00 1125.25 2 1500.00 1914.23 1000.00 1335.00 1125.25 3 2000.00 1914.23 2000.00 1335.00 1125.25 5 1000.00 1914.23 2000.00 1335.00 1125.25 755 6 2000.00 1914.29 1000.00 1335.00 1125.25 755 6 2000.00 1914.29 1000.00 800.00 1125.25 755 7 2000.00 1914.29 1005.00 800.00 1125.25 755 8 2000.00 1914.29 1005.00 800.00 1125.25 600 10 4000.00 1914.29 1343.33 800.00 1125.25 600 11 4000.00 1914.29 670.00 800.00 1125.25 600 12 2000.00 1914.29 670.00 800.00 1125.25 </th <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>								
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Months Fastenal Company - KY Assembly Fasteners Inc McMaster-Car Fastener Superstore Fastener Superstore McMaster-Car 1 1500.00 6700.00 2010.00 1335.00 1125.25	31 McMaster 90276A110	McMaster 91102A031	McMaster 911024030	McMaster 902794827	McMaster 90675A029	McMaster 90064A430	Eastenal 32392	
2 150.00 1914.29 1000.00 1335.00 1125.25 3 2000.00 1914.29 1000.00 1335.00 1125.25 3000 4 3500.00 1914.29 1000.00 1335.00 1125.25 775 5 1000.00 1914.29 1000.00 800.00 1125.25 775 6 2000.00 1914.29 1005.00 800.00 1125.25 755 8 2000.00 1914.29 1005.00 800.00 1125.25 600 9 3500.00 1914.29 1343.33 800.00 1125.25 600 11 4000.00 1914.29 1343.33 800.00 1125.25 600 12 3000.00 1914.29 670.00 800.00 1125.25 600 13 4000.00 1914.29 670.00 800.00 1125.25 600 14 1000.00 1914.29 670.00 800.00 1125.25 1000 14 1000.0	Fastener Superstore	McMaster-Carr	Fastener Superstore	Fastener Superstore	McMaster-Carr	Assembly Fasteners, Inc	Fastenal Company - KY	Months
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Ordering Process



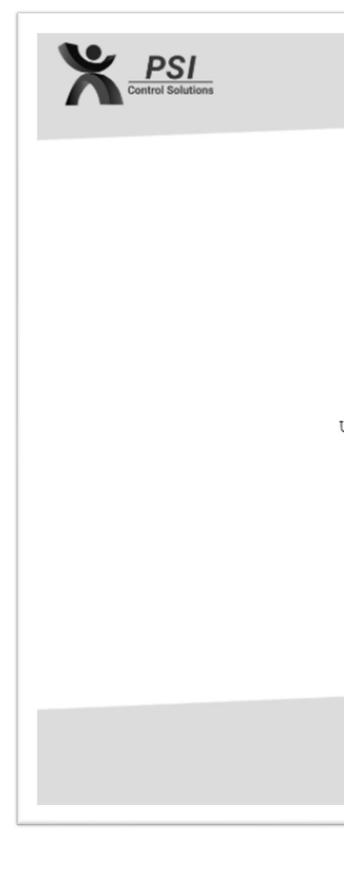
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Volume		Total Volume	Order size	Order size*Volur
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	0.014	0.034	5000	172.4
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d Verification by Volume -Medium Small olume: 288 in^2 Volume: 144 in ^2 lume Maximum order size Bin Size **Bin Volume** 306.000 22% 11430 Large 931 56% 8873 Large 306.000 144.000 20% 5018 Small 144.000 11%

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Operations and Implementation

An operations manual detailing the system has been drafted for seamless handover, and implementation of the proposed system. Contents for the manual include: Introduction, Concept of Operations, Inventory List, Inventory Analysis, Two-Kan-Ban Design, Storage Organization, Wireless Scanner, Ordering, Installing New Part, Setting up Email, Capturing Historical Data, Maintenance, Conclusions and References.

Operations Guide PSI Control Solutions	Table of Contents Introduction 1 Concept of Operations 2 Inventory List 3 Inventory Analysis 4 Two-Kan-Ban Design 4 Storage Organization 5 Wireless Scanner 5 Ordering 6 Installing New Part 7
niversity of North Carolina at Charlotte Senior Design 2021	Installing New Part