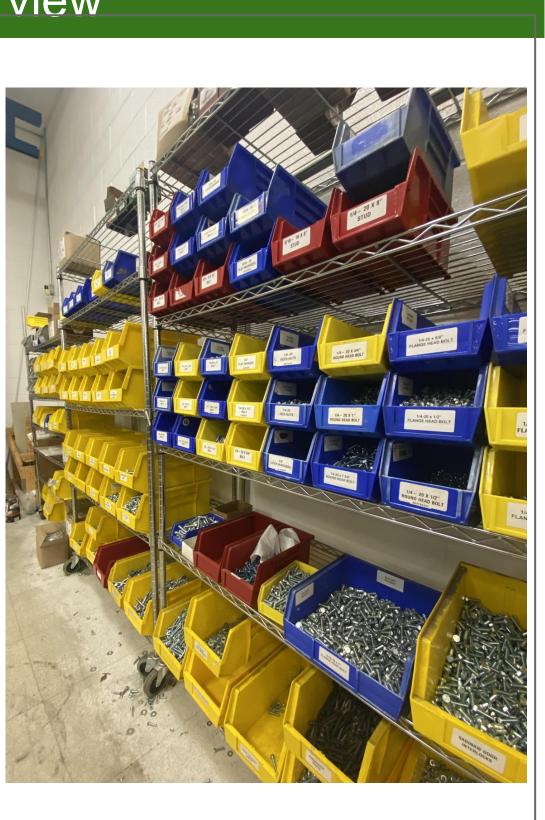


#### **Project Overview**

**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.

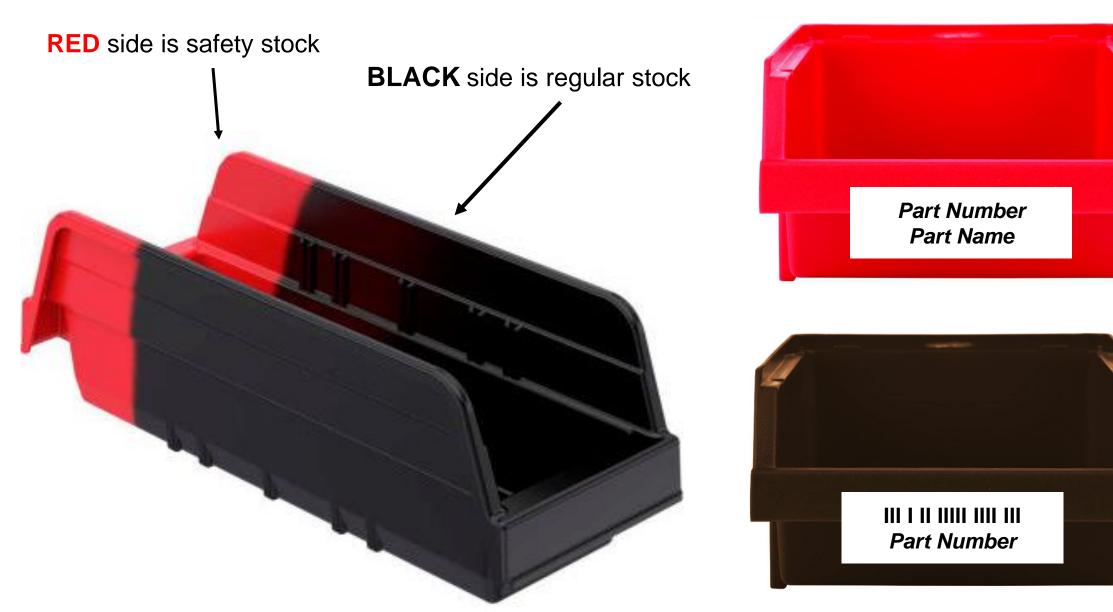


### System Criteria and Customer Priority

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.



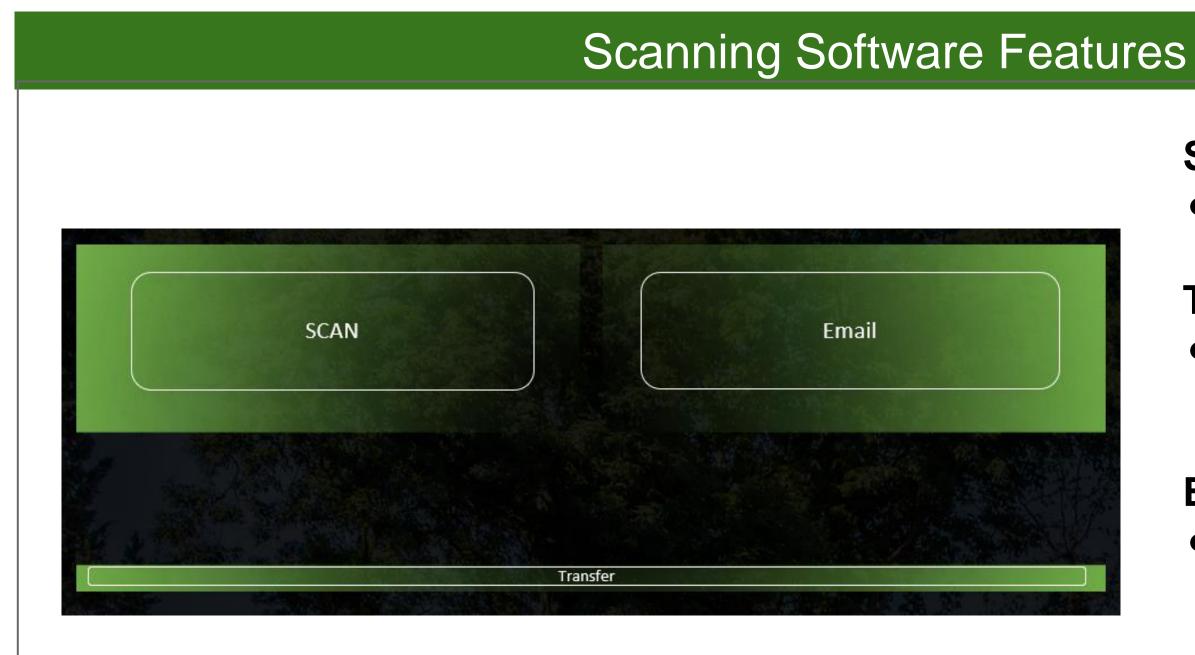
# **Design for Small Parts Replenishment System** Senior Design II - FALL 2021

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		<ul><li>Reord</li><li>Safety</li></ul>	· · · · · · · · · · · · · · · · · · ·						
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 <b>der</b> 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	<b>97 Y</b> 2500	UNIT PRICE	EXT PRICE 44.41			
	McMaster		0.02	38.03			
				-			
				-			
				-			
				-			
				-			
				-			
				-			
				-			
				-			
				-			
				-			
				-			
		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**

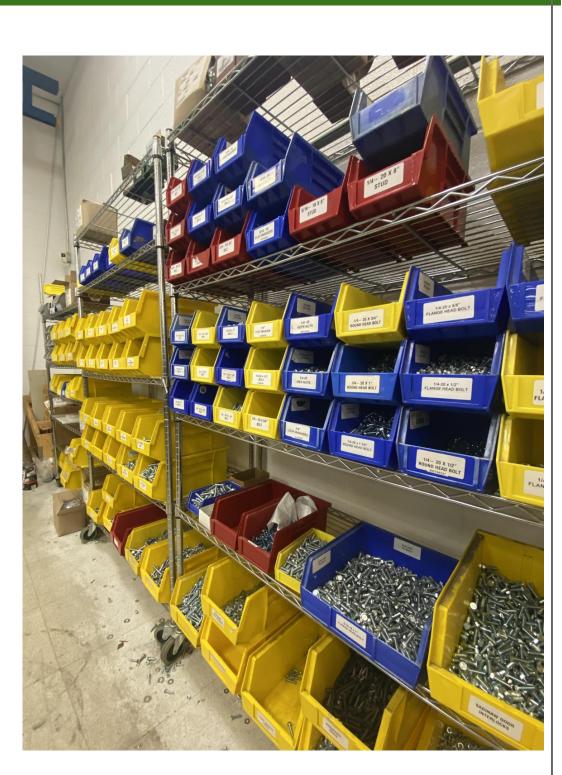
**PSI** Control Solutions needs a system to maintain "shop parts" including nuts, bolts and washers. By redesigning the storage devices, and implementing a process for ordering, receiving and storing, PSI Control Solutions can maximize return on investment, while minimizing chances for stock-outs.

## System

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



# Project Overview



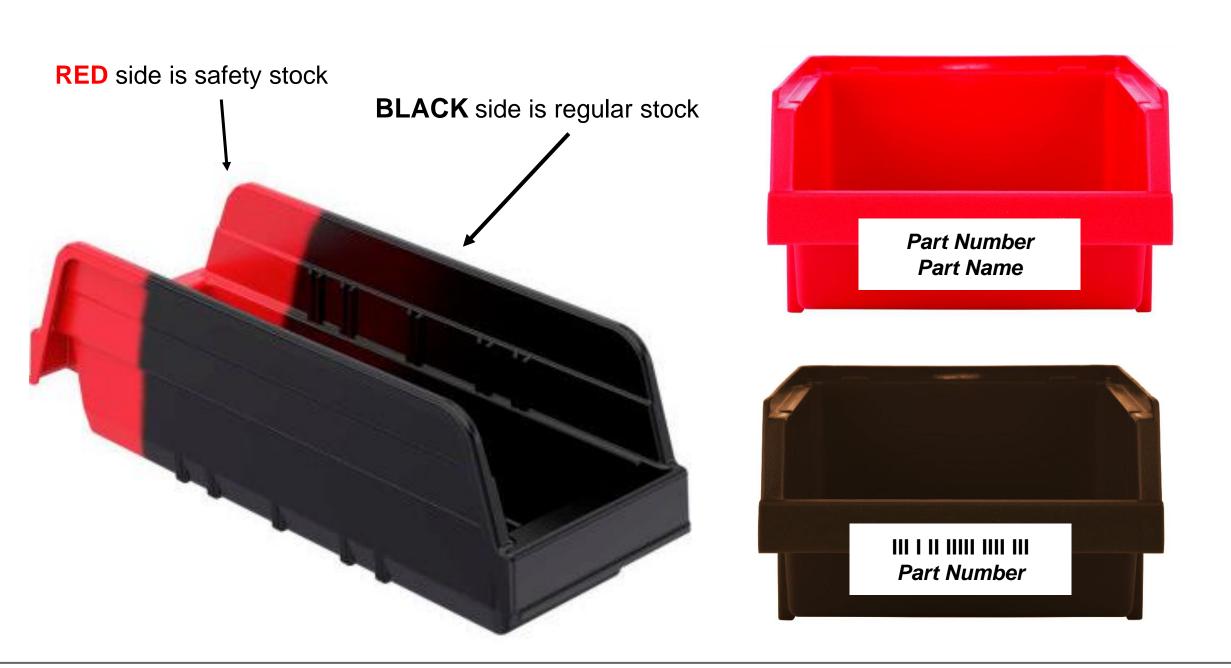


n	Criteria	and	Customer	Priority
				-

5. Implementation Timeline

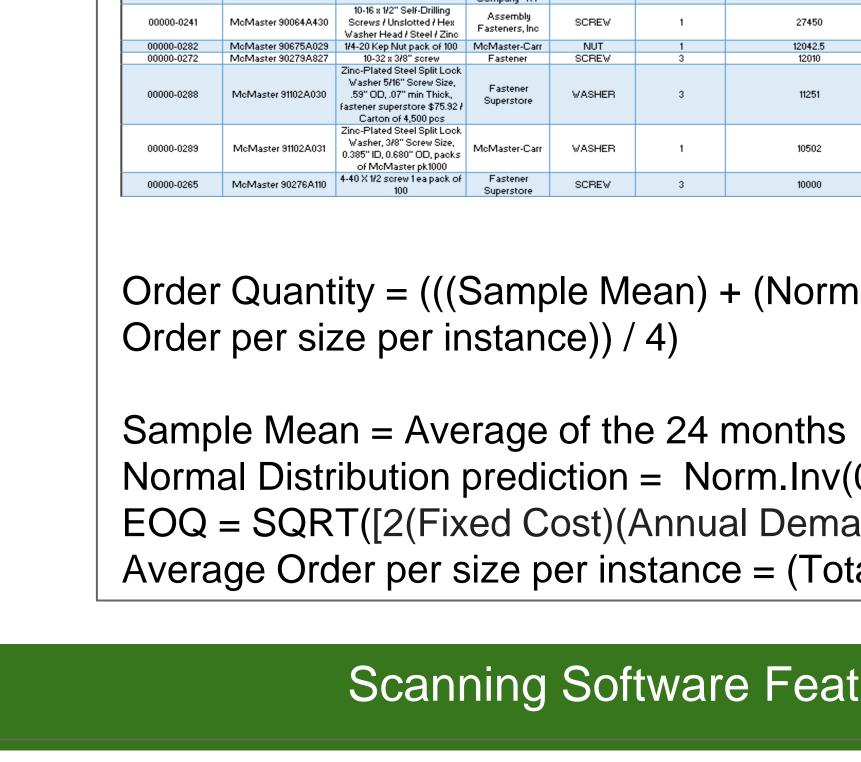
21% 30% 14.9% 12.6% 6.3% 3.2% 2.9% 3.09 5.4%

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.

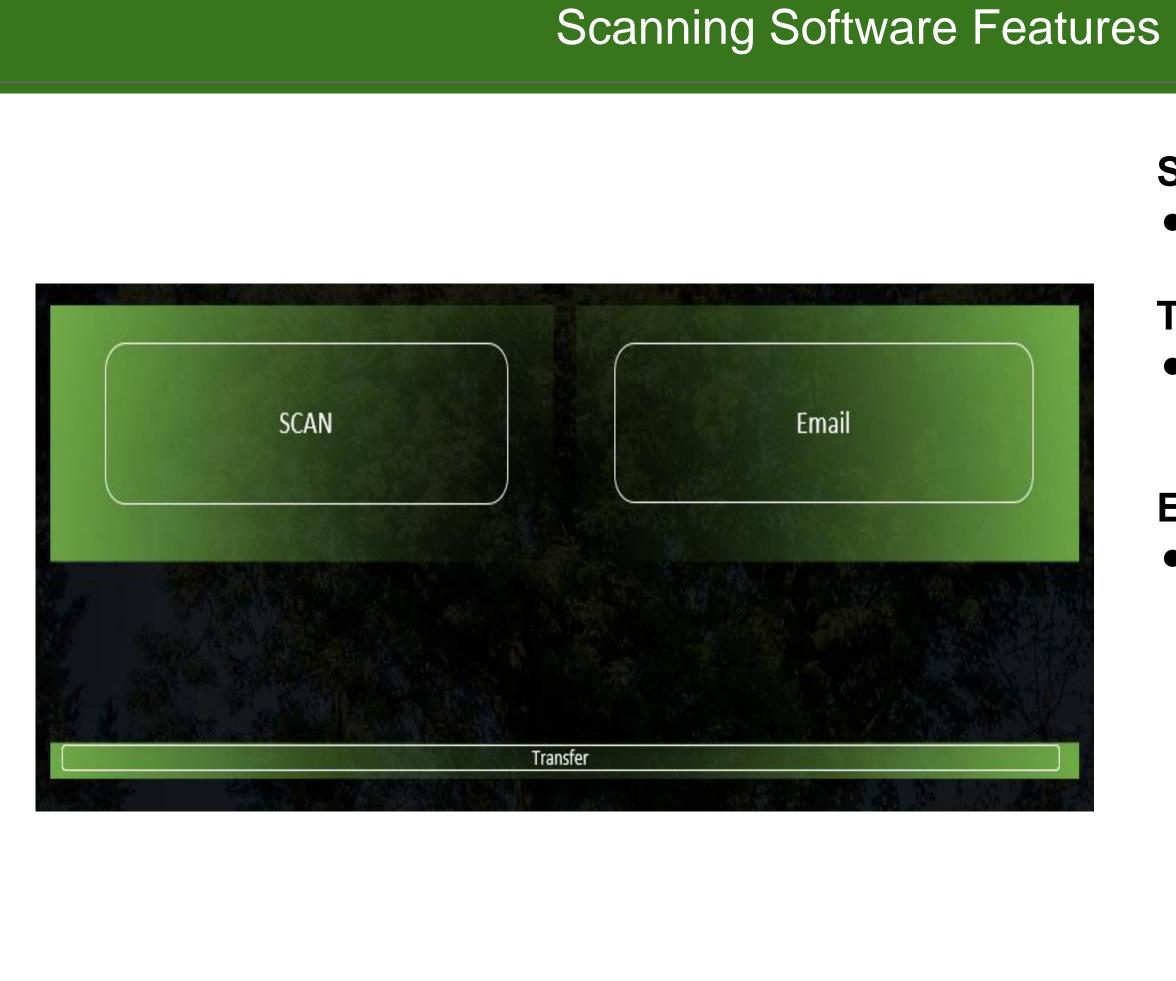




## 2 Bin KanBan Design



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

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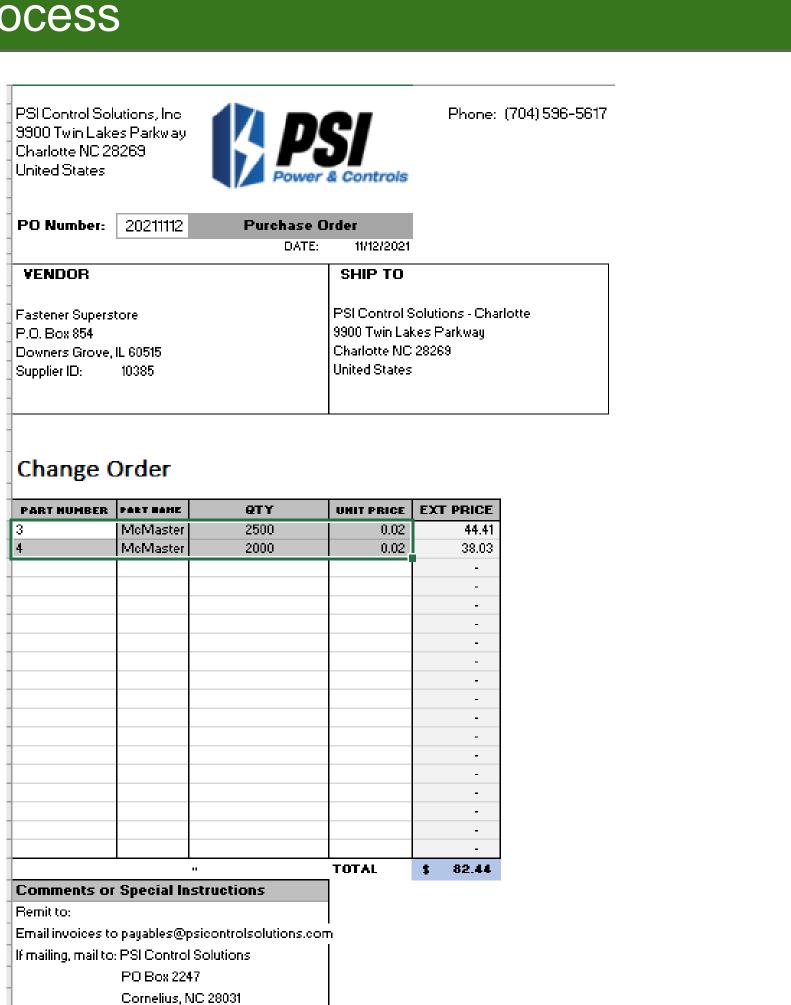
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 Creates a table of what is scanned, and automatically generates an email ready to send via Outlook

 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>								
Months     Fastenal Company - KY     Assembly Fasteners Inc     McMaster-Car     Fastener Superatore     Fastener Superatore     McMaster-Car       1     1500.00     6700.00     2010.00     1335.00     1125.25								
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
3     2000.00     1914.23     1000.00     1335.00     1125.25     300       4     3500.00     1914.23     2000.00     1335.00     1125.25     75       5     1000.00     1914.23     1000.00     1335.00     1125.25     75       7     2000.00     1914.23     1005.00     800.00     1125.25     755       7     2000.00     1914.29     1005.00     800.00     1125.25     60       9     3500.00     1914.29     1934.33     800.00     1125.25     60       10     4000.00     1914.29     1343.33     800.00     1125.25     60       11     4000.00     1914.29     1343.33     800.00     1125.25     50       12     3000.00     1914.29     670.00     800.00     1125.25     50       13     4000.00     1914.29     670.00     800.00     1125.25     100       14     1000.00     1914.29     1005.00     800.00     1125.25     100       15								1
4     3500.00     1914.25     2000.00     1335.00     1125.25     755       6     2000.00     1914.29     1000.00     1335.00     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     765       8     2000.00     1914.29     1035.00     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     100       14     1000.00     1914.29     1005.00     1001.25     1125.25     100       14     1000.00     1914.29     1005.00     1001.25     1125.25     100       14<								2
5     1000.00     1914.29     1000.00     1335.00     1125.25     75       7     2000.00     1914.29     1000.00     800.00     1125.25     75       8     2000.00     1914.29     1005.00     800.00     1125.25     55       9     3500.00     1914.29     1005.00     800.00     1125.25     60       9     3500.00     1914.29     1343.33     800.00     1125.25     60       10     4000.00     1914.29     1343.33     800.00     1125.25     60       11     4000.00     1914.29     670.00     800.00     1125.25     60       12     3000.00     1914.29     670.00     800.00     1125.25     60       13     4000.00     1914.29     670.00     800.00     1125.25     100       14     1000.00     1914.29     1000.00     1001.25     1125.25     755       16     1000.00     1914.29     1000.00     1001.25     1125.25     755       16								3
6     2000.00     1914.29     1000.00     800.00     1125.25     755       8     2000.00     1914.23     1005.00     800.00     1125.25     600       9     3500.00     1914.23     1005.00     800.00     1125.25     600       9     3500.00     1914.23     1343.33     800.00     1125.25     600       10     4000.00     1914.23     1343.33     800.00     1125.25     600       11     4000.00     1914.23     1343.33     800.00     1125.25     600       12     3000.00     1914.23     670.00     800.00     1125.25     500       13     4000.00     1914.23     670.00     800.00     1125.25     100       14     1000.00     1914.23     670.00     800.00     1125.25     100       14     1000.00     1914.23     1005.00     800.00     1125.25     100       15     2500.00     1914.23     1005.00     800.00     1125.25     100       16 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>4</td>								4
7     2000.00     1914.29     1005.00     800.00     1125.25     75       6     2000.00     1914.29     1005.00     800.00     1125.25     60       9     3500.00     1914.29     1343.33     800.00     1125.25     60       10     4000.00     1914.29     1343.33     800.00     1125.25     60       11     4000.00     1914.29     1343.33     800.00     1125.25     60       12     3000.00     1914.29     670.00     800.00     1125.25     60       13     4000.00     1914.29     670.00     800.00     1125.25     100       14     1000.00     1914.29     1005.00     800.00     1125.25     100       15     250.00     1914.29     1005.00     800.00     1125.25     100       16     1000.00     1914.29     1000.00     1001.25     1125.25     755       18     2500.00     1914.29     1000.00     1001.25     1125.25     755       19								5
8     2000     1914.29     1005.00     900.00     1125.25     600       9     3500.00     1914.29     1343.33     800.00     1125.25     600       10     4000.00     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     100       14     1000.00     1914.29     670.00     800.00     1125.25     100       16     1000.00     1914.29     1005.00     800.00     1125.25     100       16     1000.00     1914.29     1005.00     1001.25     1125.25     755       17     2020.00     1914.29     1000.00     1001.25     1125.25     755       19     1500.00     133.33     1000.00     1001.25     1125.25     755       19 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>								
9     3500.00     1914.29     1343.33     800.00     1125.25     600       10     4000.00     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     100       14     1000.00     1914.29     670.00     800.00     1125.25     100       15     2500.00     1914.29     1005.00     800.00     1125.25     100       16     1000.00     1914.29     1005.00     800.00     1125.25     75       18     2500.00     1914.29     1000.00     1001.25     1125.25     75       19     1500.00     133.33     1000.00     1001.25     1125.25     75       20     500.00     1333.33     1000.00     1001.25     1125.25     100       21 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>								
10     4000.00     1914.29     1343.33     800.00     1125.25     60       11     4000.00     1914.29     1343.33     800.00     1125.25     60       12     3000.00     1914.29     670.00     800.00     1125.25     600       13     4000.00     1914.29     670.00     800.00     1125.25     1000       14     1000.00     1914.29     670.00     800.00     1125.25     1000       15     2500.00     1914.29     1005.00     800.00     1125.25     750       16     1000.00     1914.29     1005.00     1001.25     1125.25     751       17     2020.00     1914.29     1000.00     1001.25     1125.25     751       19     1500.00     1933.33     1000.00     1001.25     1125.25     751       20     500.00     1333.33     1000.00     1001.25     1125.25     1000       21     200.00     1333.33     1000.00     1001.25     1125.25     1000       <								9
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     1000       14     1000.00     1914.29     670.00     800.00     1125.25     1000       15     2500.00     1914.29     1005.00     800.00     1125.25     1000       16     1000.00     1914.29     1005.00     800.00     1125.25     750       17     2020.00     1914.29     1000.00     1001.25     1125.25     751       18     2500.00     1914.29     1000.00     1001.25     1125.25     751       20     500.00     1333.33     1000.00     1001.25     1125.25     751       21     2000.00     1333.33     1000.00     1001.25     1125.25     1000       22     4000.00     1333.33     1000.20     1001.25     1125.25     1000								
12     3000.00     1914.29     670.00     800.00     1125.25     600       13     4000.00     1914.29     670.00     800.00     1125.25     1000       14     1000.00     1914.29     670.00     800.00     1125.25     1000       15     2500.00     1914.29     1005.00     800.00     1125.25     1000       16     1000.00     1914.29     1005.00     1001.25     1125.25     750       17     2020.00     1914.29     1000.00     1001.25     1125.25     750       18     2500.00     1914.29     1000.00     1001.25     1125.25     750       19     1500.00     133.33     1000.00     1001.25     1125.25     750       20     500.00     133.33     1000.00     1001.25     1125.25     1000       21     2000.00     1333.33     1000.00     1001.25     1125.25     1000       22     4000.00     1333.33     1002.50     1001.25     1125.25     1000								
13     4000.00     1914.29     670.00     800.00     1125.25     100       14     1000.00     1914.29     670.00     800.00     1125.25     1000       15     2500.00     1914.29     1005.00     800.00     1125.25     1000       16     1000.00     1914.29     1005.00     1001.25     1125.25     750       17     2020.00     1914.29     1000.00     1001.25     1125.25     751       18     2500.00     1914.29     1000.00     1001.25     1125.25     751       19     1500.00     1333.33     1000.00     1001.25     1125.25     751       20     500.00     1333.33     1000.00     1001.25     1125.25     1000       21     200.00     1333.33     1000.00     1001.25     1125.25     1000       22     4000.00     1333.33     1002.50     1001.25     1125.25     1000       23     1000.00     1333.33     1002.50     1335.00     1125.25     1500								12
14     1000.00     1914.29     670.00     800.00     1125.25     1000       15     2500.00     1914.29     1005.00     800.00     1125.25     1000       16     1000.00     1914.29     1005.00     1001.25     1125.25     750       17     2020.00     1914.29     1000.00     1001.25     1125.25     750       18     2500.00     1914.29     1000.00     1001.25     1125.25     750       19     1500.00     1333.33     1000.00     1001.25     1125.25     750       20     500.00     1333.33     1000.00     1001.25     1125.25     1000       21     2000.00     1333.33     1000.00     1001.25     1125.25     1000       22     4000.00     1333.33     1000.260     1001.25     1125.25     1000       23     1000.00     1333.33     1002.50     1001.25     1125.25     1500       24     3000.00     1333.33     1002.50     1335.00     1125.25     1500  <								
15     2500.00     1914.29     1005.00     800.00     1125.25     1000       16     1000.00     1914.29     1005.00     1001.25     1125.25     755       17     2020.00     1914.29     1000.00     1001.25     1125.25     756       18     2500.00     1914.29     1000.00     1001.25     1125.25     756       19     1500.00     1933.33     1000.00     1001.25     1125.25     756       20     500.00     1333.33     1000.00     1001.25     1125.25     1000       21     2000.00     1333.33     1000.00     1001.25     1125.25     1000       22     4000.00     1333.33     1000.00     1001.25     1125.25     1000       23     1000.00     1333.33     1000.20     1001.25     1125.25     1500       24     3000.00     1333.33     1002.50     1335.00     1125.25     1500       Sample STD     1102.31     1039.60     379.16     216.03     0.00     568								
16     1000.00     1914.29     1005.00     1001.25     1125.25     750       17     2020.00     1914.29     1000.00     1001.25     1125.25     750       18     2500.00     1914.29     1000.00     1001.25     1125.25     750       19     1500.00     1333.33     1000.00     1001.25     1125.25     750       20     500.00     1333.33     2000.00     1001.25     1125.25     1000       21     2000.00     1333.33     1000.00     1001.25     1125.25     1000       22     4000.00     1333.33     1000.00     1001.25     1125.25     1000       23     1000.00     1333.33     1002.50     1001.25     1125.25     1500       24     3000.00     1333.33     1002.50     1335.00     1125.25     1500       Sample STD     1102.31     1039.60     379.16     216.03     0.00     560       Sample Mean     2292.50     1968.45     1128.13     1000.83     1125.25     87				800.00			2500.00	
18     2500.00     1914.29     1000.00     1001.25     1125.25     750       19     1500.00     1333.33     1000.00     1001.25     1125.25     750       20     500.00     1333.33     2000.00     1001.25     1125.25     1000       21     2000.00     1333.33     1000.00     1001.25     1125.25     1000       22     4000.00     1333.33     1000.00     1001.25     1125.25     1000       23     1000.00     1333.33     1000.00     1001.25     1125.25     1500       24     3000.00     1333.33     1002.50     1001.25     1125.25     1500       24     3000.00     1333.33     1002.50     1335.00     1125.25     1500       Sample STD     1102.31     1039.60     379.16     216.03     0.00     568       Sample Mean     2292.50     1968.45     1128.13     1000.83     1125.25     87       Mean Lead Time     3.00     1.00     1.00     3.00     3.00     3.00	00 833.33	750.00	1125.25	1001.25			1000.00	16
19     1500.00     1333.33     1000.00     1001.25     1125.25     750       20     500.00     1333.33     2000.00     1001.25     1125.25     1000       21     2000.00     1333.33     1000.00     1001.25     1125.25     1000       22     4000.00     1333.33     1000.00     1001.25     1125.25     1000       23     1000.00     1333.33     1000.00     1001.25     1125.25     1500       24     3000.00     1333.33     1002.50     1335.00     1125.25     1500       24     3000.00     1333.33     1002.50     1335.00     1125.25     1500       Sample STD     1102.31     1039.60     379.16     216.03     0.00     560       Sample Mean     229.50     1968.45     1128.13     1000.83     1125.25     87       Mean Lead Time     3.00     1.00     1.00     3.00     3.00     3.00     3.00     3.00     3.00     3.00     3.00     3.00     3.00     3.00     3.0	00 833.33	750.00	1125.25	1001.25	1000.00	1914.29	2020.00	17
20     500.00     1333.33     2000.00     1001.25     1125.25     1000       21     2000.00     1333.33     1000.00     1001.25     1125.25     1000       22     4000.00     1333.33     1000.00     1001.25     1125.25     1000       23     1000.00     1333.33     1002.50     1001.25     1125.25     1000       24     3000.00     1333.33     1002.50     1001.25     1125.25     1500       24     3000.00     1333.33     1002.50     1335.00     1125.25     1500       Sample STD     1102.31     1039.60     379.16     216.03     0.00     560       Sample Mean     2292.50     1968.45     1128.13     1000.83     1125.25     87       Mean Lead Time     3.00     1.00     1.00     3.00     3.00     3.00     3.00     1000     1000     1000     3.00     3.00     0.00     3.00     1000     1000     1000     1000     3.00     3.00     0.00     0.00     1000								
21     2000.00     1333.33     1000.00     1001.25     1125.25     1000       22     4000.00     1333.33     1000.00     1001.25     1125.25     1000       23     1000.00     1333.33     1002.50     1001.25     1125.25     1500       24     3000.00     1333.33     1002.50     1335.00     1125.25     1500       24     3000.00     1333.33     1002.50     1335.00     1125.25     1500       Sample STD     1102.31     1039.60     379.16     216.03     0.00     560       Sample Mean     2292.50     1968.45     1128.13     1000.83     1125.25     87       Mean Lead Time     3.00     1.00     1.00     3.00 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>								
22     4000.00     1333.33     1000.00     1001.25     1125.25     1000       23     1000.00     1333.33     1002.50     1001.25     1125.25     1500       24     3000.00     1333.33     1002.50     1335.00     1125.25     1500       Sample STD     1102.31     1039.60     379.16     216.03     0.00     560       Sample Mean     2292.50     1968.45     1128.13     1000.83     1125.25     87       Mean Lead Time     3.00     1.00     300     3.00     <								
23     1000.00     1333.33     1002.50     1001.25     1125.25     1500       24     3000.00     1333.33     1002.50     1335.00     1125.25     1500       Sample STD     1102.31     1039.60     379.16     216.03     0.00     560       Sample Mean     2292.50     1968.45     1128.13     1000.83     1125.25     87       Mean Lead Time     3.00     1.00     1.00     3.00 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>21</td>								21
243000.001333.331002.501335.001125.251500Sample STD1102.311039.60379.16216.030.00560Sample Mean2292.501968.451128.131000.831125.2587Mean Lead Time3.001.001.003.003.003.00Order Size4105.643678.441751.791356.161126.891800Price0.080.030.060.020.0200EDQ2091.003447.881791.713002.453077.052074Order Instances7352058								
Sample STD     1102.31     1039.60     379.16     216.03     0.00     568       Sample Mean     2292.50     1968.45     1128.13     1000.83     1125.25     87       Mean Lead Time     3.00     1.00     1.00     3.00     3.00     1125.25     87       Order Size     4105.64     3678.44     1751.79     1356.16     1126.89     1809       Price     0.08     0.03     0.06     0.02								
Sample Mean     2292.50     1968.45     1128.13     1000.83     1125.25     87       Mean Lead Time     3.00     1.00     1.00     3.00								
Mean Lead Time     3.00     1.00     1.00     3.00     3.00       Order Size     4105.64     3678.44     1751.79     1356.16     1126.89     1809       Price     0.08     0.03     0.06     0.02								-
Order Size     4105.64     3678.44     1751.79     1356.16     1126.89     1809       Price     0.08     0.03     0.06     0.02     0.								-
Price     0.08     0.03     0.06     0.02 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>								
ECQ     2091.00     3447.88     1791.71     3002.45     3077.05     2074       Order Instances     73     5     20     5     8								
Order Instances 73 5 20 5 8								
	11 21	11	8	5002.45 F				
Quantity Ordered 55020 54900 24085 24020 22502 21		21004	22502	24020				
								<u> </u>

# Ordering Process



		Bin As	signm	ent and
	Vc	Lar olume: 3	<b>ge</b> 306 in^2	Vo
Volume		Total Volume	Order size	Order size*Volur
	0.011	0.027	2500	66.9
	0.014	0.034	5000	172.4
	0.014	0.029	1000	28.0
	0.000	0.005	3000	16.0
•	siz bir As	e will dens.	etermine	nich the in how ma

#### 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%

individual items are used and part nany of the items are placed in the

nder in shape to calculate the

26835 Small



### **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