INDUSTRY 4.0

LAB-5

Introduction:

As going through the given Document there are different levels of system to complete the process.
The mentioned systems are

- Robot Station.
- Automation warehouse
- Input / Output station.

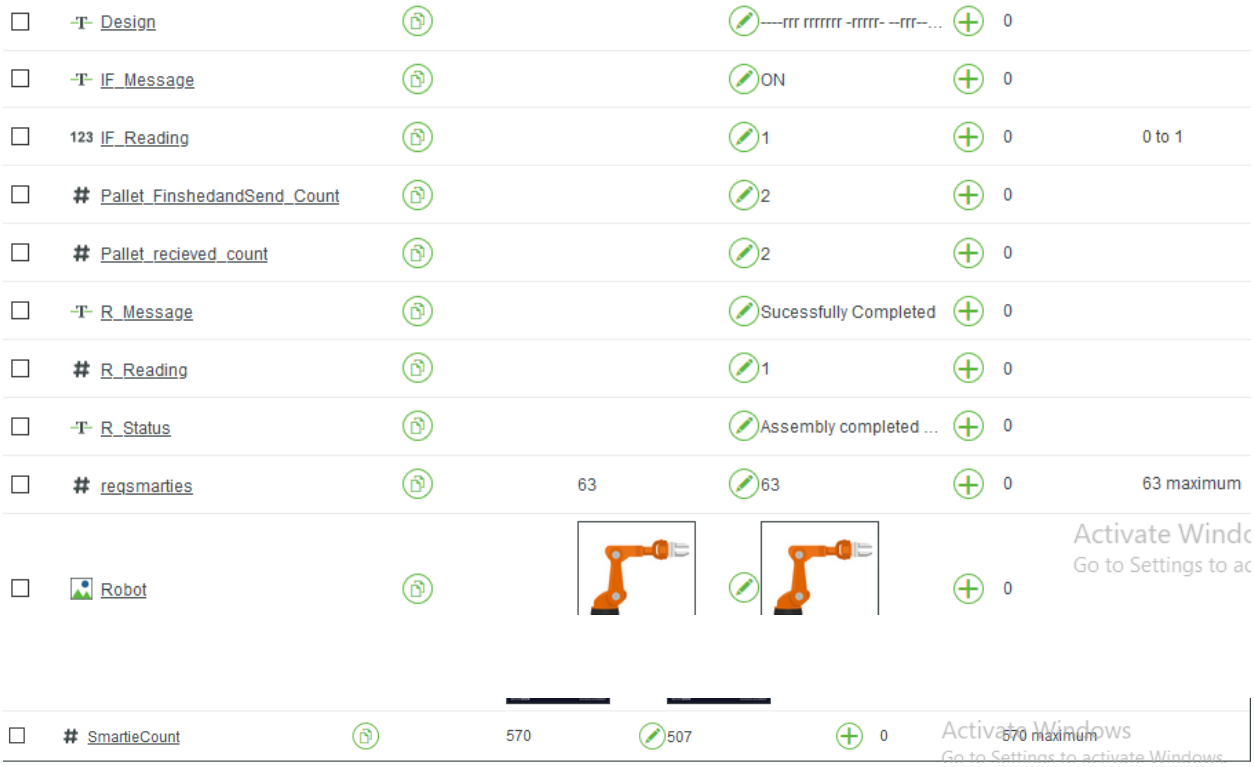
I have chosen to simulate robot station and steps and process are explained below.

DIGITAL REPRESENTATION

General Information: • Name: Robot Station • Description: This arranges the smarties as per the mentioned color input. • BasicThingTempelate: Generic Thing.	**Services:** 1. To Receive Pallet. 2. To Assemble Pallet **3.** To Send the pallet after filling. **(Codes are mentioned below)**
Properties and Alerts: • IF_Reading as INT. • IF_Message as STRING . • R_Status as STRING. • Design as String.	**Events**: null
Value Streams: Value streams comprises of data of the properties	**Subscription:** **1)**Signal from IF Sensor to turn on robot station. **(Codes are mentioned below)**

CREATING THINGS

Properties	**DataType**	**Meaning**
Design	STRING	Design series in which the smarties ha to assembled.
IF_Message	STRING	Infrared sensor Message
IF_Reading	NUMBER	Infrared sensor Reading
Pallet_FinishedandSend_Count	NUMBER	Total completed Pallet count .
Pallet_Recieved_Count	NUMBER	Total to be arranged pallet Count.
R_Message	STRING	Robot Message
R_Reading	NUMBER	Robot Reading
R_Status	STRING	Status of robot
ReqSmarties	NUMBER	Required smarties for one pallet
SmartieCount	NUMBER	Total smarties inclusive of all color in stock

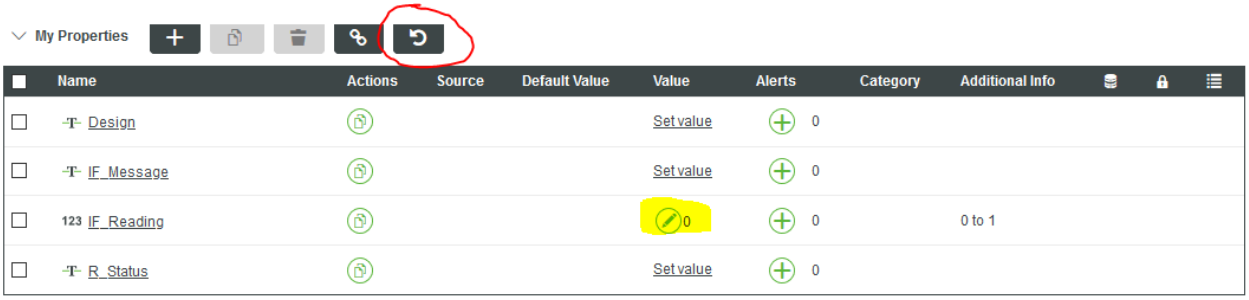


SUBSCRIPTION:

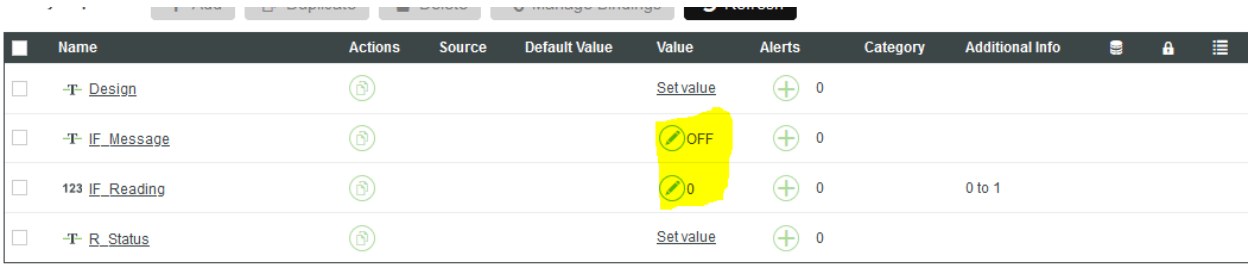
Signal from IF Sensor to turn on robot station.

CODE	EXPLANATION

if(me.IF_Reading==1)
{
me.IF_Message="ON";
me.R_Reading=1;
}
else if(me.IF_Reading==0)
{
me.IF_Message="OFF";
}
	Whenever the IF Sensor near the assembling robot detects the pallet the value will become 1 (i.e: Turn ON message to robot) and also after the robot is turned ON the message to the user is given as “ON” this process is vice versa when there is no pallets detected.



When the value is SET to 0 and REFRESH Button is clicked the message changes to 'OFF' which is shown in below picture.



SERVICES:

1. To Receive Pallet.
2. To Assemble Pallet
3. To Send the pallet after filling.

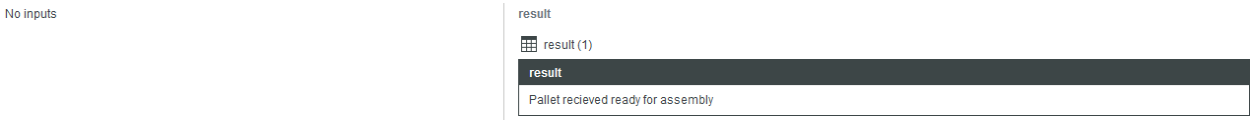
1) RECEIVE PALLET:

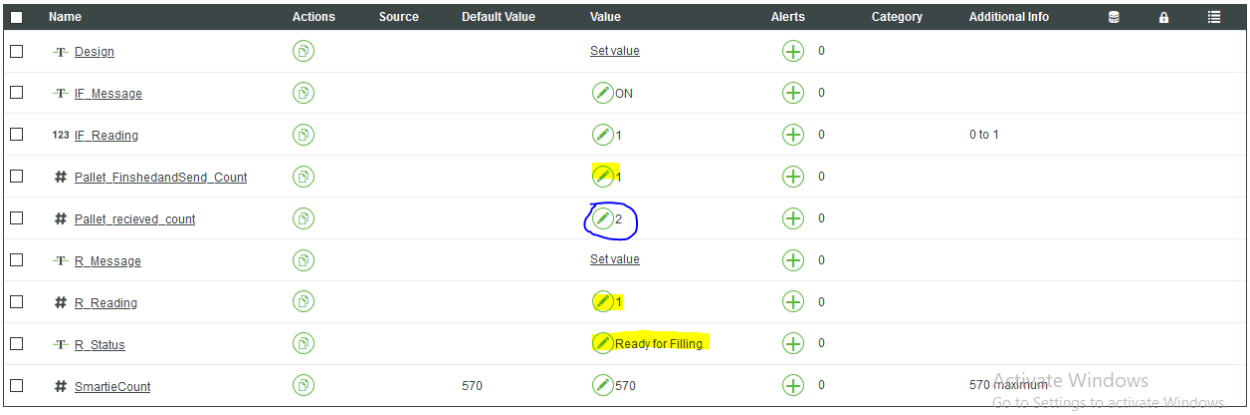
Code	Explanation

if(me.Pallet_recieved_count==me.Pallet_FinshedandSend_Count & me.Pallet_recieved_count>0)
{
if(me.R_Reading==1)
{
R_Message="Pallet received";
result="Pallet recieved ready for assembly";
	• When the **pallet received count** for filling is **equal** to **filled pallet finish count** and also the **palletcount** should be greater than **zero,** Additionally the R_Reading should be One.

me.Pallet_recieved_count++;
me.R_Status="Ready for Filling";
}
else
{
result="pallet is filling";
me.R_Status="Filling Pallet";
}
}
else
{
result="Robert is OFF";
me.R_Status="OFF";
}
	Then the Robert will receive the pallet else the R_Reading is some other value that means already there is pallet for filling.
	• If the above Condition is failed than it means the Robert is OFF

When all Condition is Passed:





While the Robert is Filling:

Name	Actions	Source	Default Value	Value	Alerts	Category	Additional Info
Design				Set value	0		
IF_Message				ON	0		
IF_Reading				1	0		0 to 1
Pallet_FinshedandSend_Count				1	0		
Pallet_recieved_count				1	0		
R_Message				Set value	0		
R_Reading				0	0		
R_Status				Filling Pallet	0		
SmartieCount			570	570	0		570 maximum

Inputs

No inputs

Output + Data Shape

result

result (1)

result
pallet is filling

When Condition is Failed:

Name	Actions	Source	Default Value	Value	Alerts	Category	Additional Info
Design				Set value	0		
IF_Message				Set value	0		
IF_Reading				0	0		0 to 1
Pallet_FinshedandSend_Count				0	0		
Pallet_recieved_count				0	0		
R_Message				Set value	0		
R_Reading				0	0		
R_Status				Set value	0		
SmartieCount			570	570	0		570 maximum

Inputs

No inputs

Output + Data Shape

result

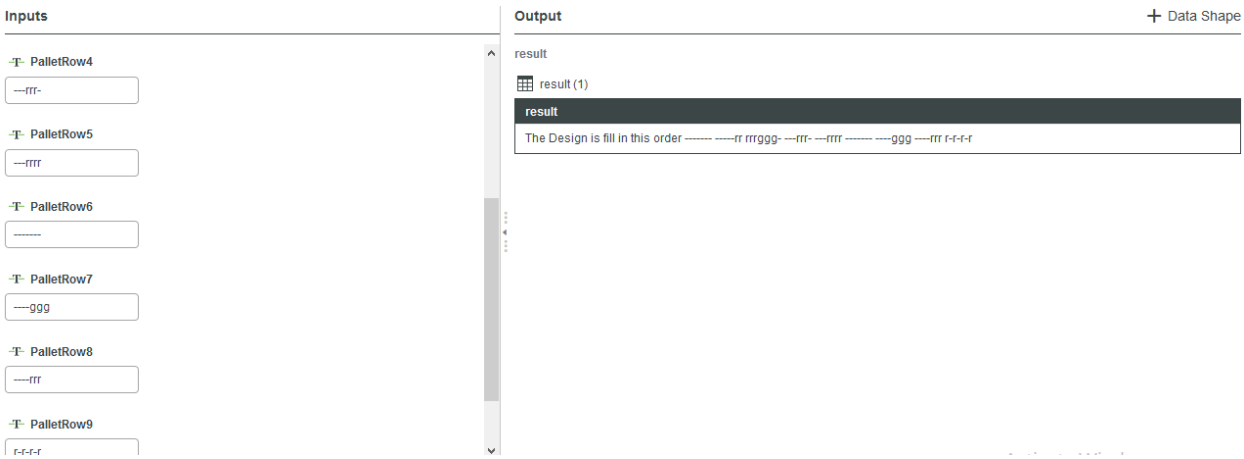
result (1)

result
Robert is OFF

2. Assemble Pallet

Code	Explanation

if(me.R_Status=="Ready for Filling" & me.SmartieCount>63)
{
me.Design="\n"+PalletRow1+"\n"+PalletRow2+"\n"+PalletRow3+
"\n"+PalletRow4+"\n"+PalletRow5+"\n"+PalletRow6+
"\n"+PalletRow7+"\n"+PalletRow8+"\n"+PalletRow9;
 	
me.R_Status="Filling will take 60 seconds";
 	
result="\n Filling the pallet as per this design"+me.Design;
 	
me.SmartieCount=me.SmartieCount-63;
me.R_Message="Sucessfully Completed";
}
Else if(me.SmartieCount<63)
{
me.R_Status="Smarties are less awaiting refill of smarties";
}
	When th]e Robert status is ready for filling the Design input color code has to be given in the order of 1-63 from row 1 to 9.Each row is allowed to have 7 smartie colors.
	
	R-red, G-green & etc.
	
	After this the smartie count is reduced 63 because each smartie pallet occupy 63 smarties.



By giving the input the smartie color code, the design is generated as expected.

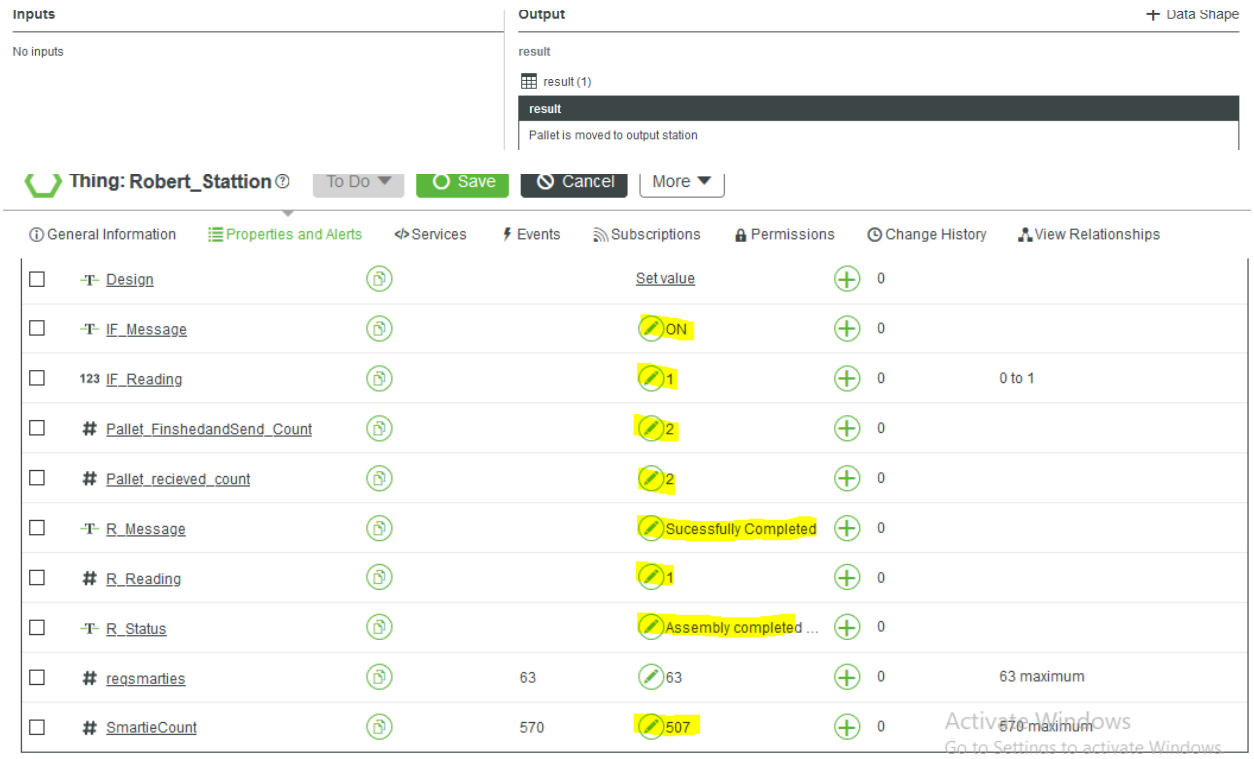
3)To Send the pallet to OP station after filling:

Code	Explanation

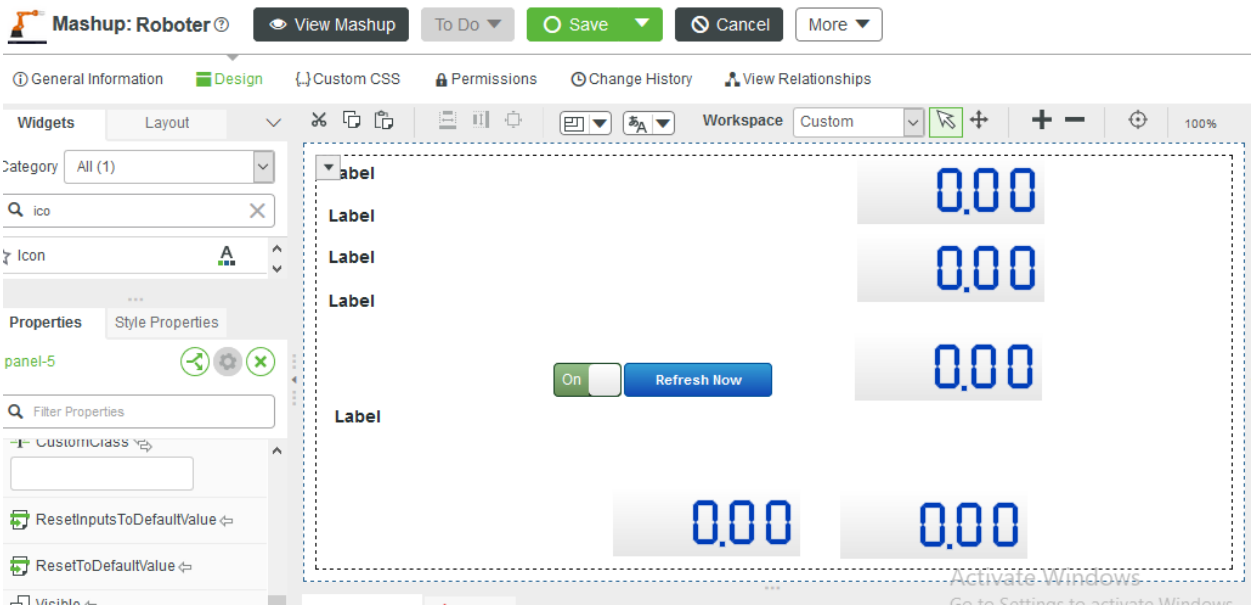
if(me.R_Message=="Sucessfully Completed")
{
me.R_Status="Assembly completed send the pallet to OUTPUT STATION";
me.Pallet_FinshedandSend_Count++;
	When all the above condition is satisfied the final procedure for sending the filled pallet to output station is done.

```
    result="Pallet is moved to output station";
}
```

Result:

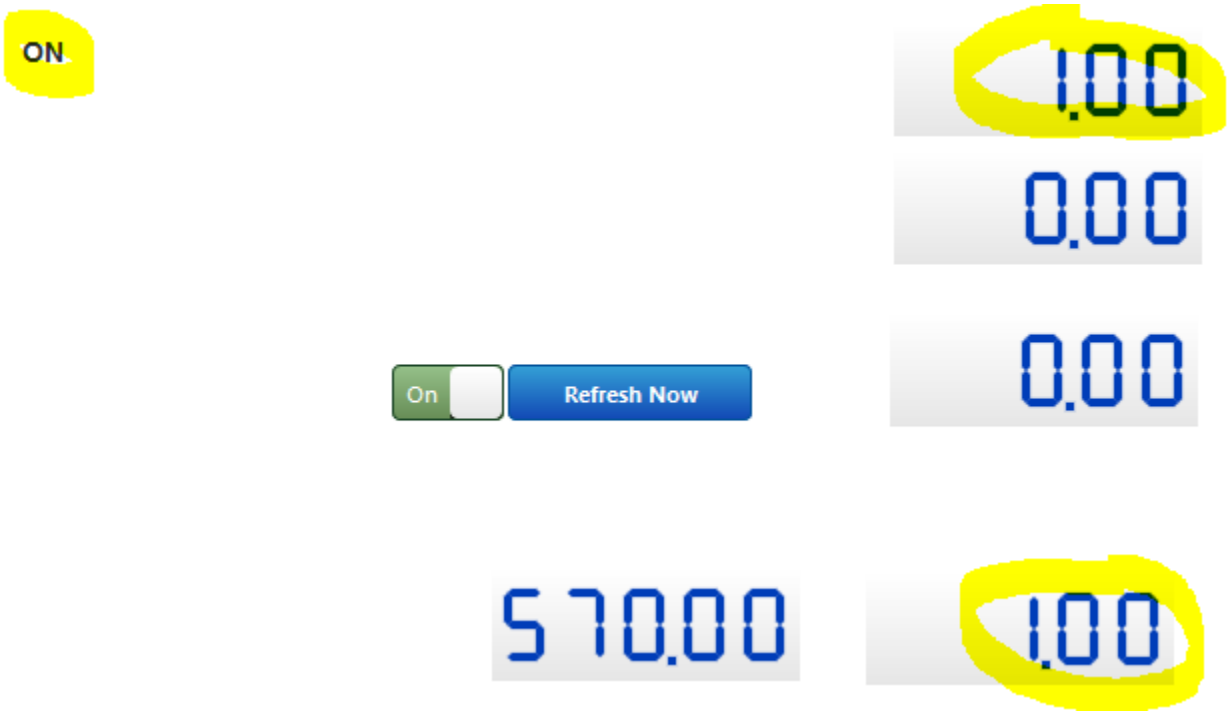


MashUp:



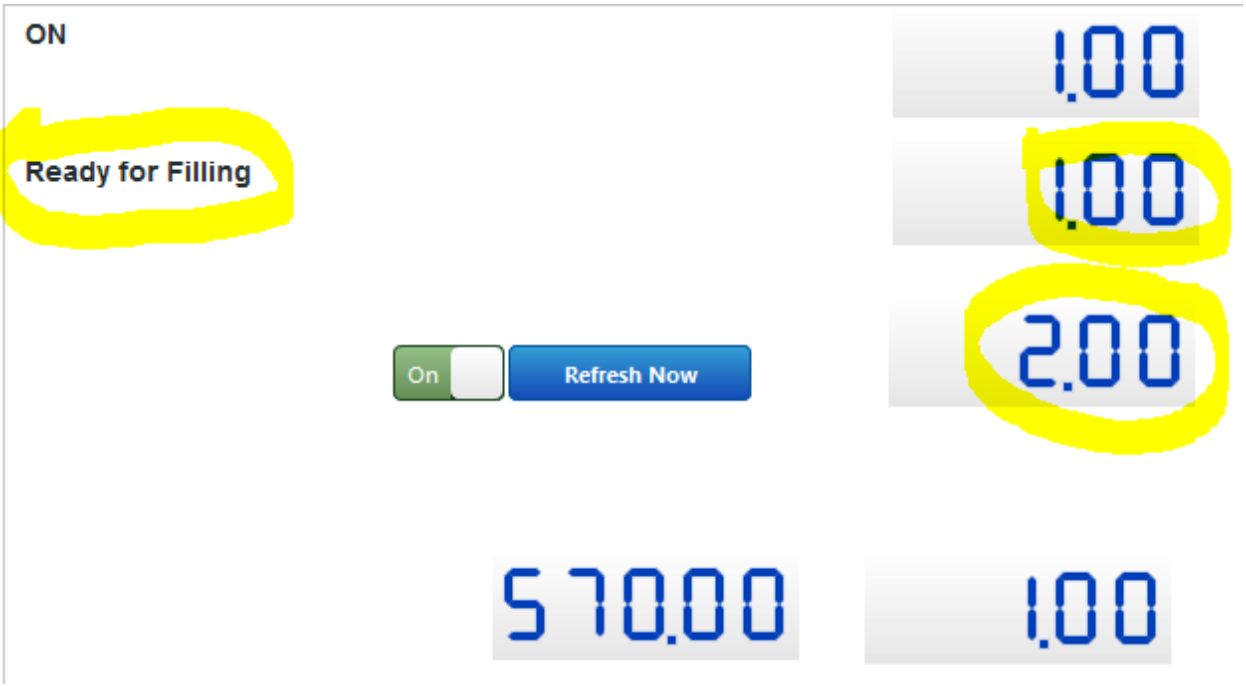
1)**When IF is Switched ON:**

- When IF(infrared sensor) value becomes 1 It says that the pallet is sent for filling. So the Robert is Turned ON and Robert Reading will become 1.



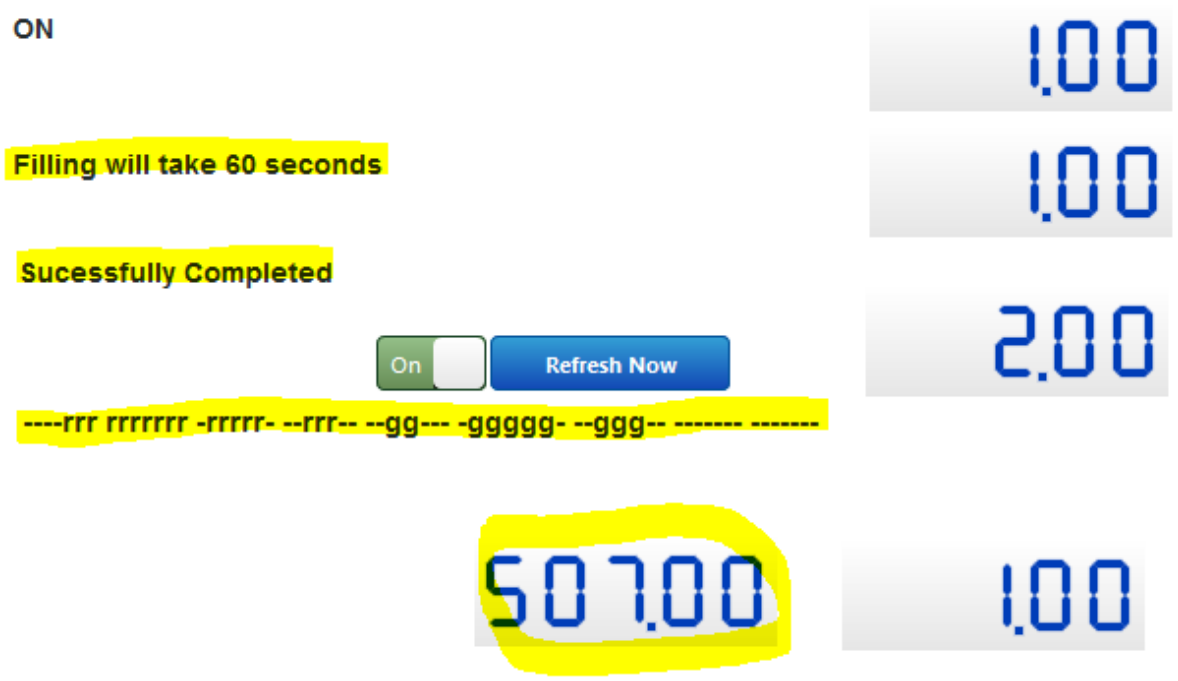
2)**When Add Pallet Service is invoked**

The Count of Pallet Sent for Assembly and also the Count of Pallet received will be displayed.



3)**When Design service is invoked**

When the Design sevices is invoked the **Design ,Status of Design,Timing and Final Smartie Count in Stock** everything is designed.



4.**Final Step:**

When the final services for sending the pallet to the output station is invoked. the further required results can be seen.

Lesson Learnt:

By completing the tasks given a fully Automated Robot for Assembling is Simulated. However, while doing with the real time experiment we must know about the full functionality and working of the rover if each and every parameter of sensor and devices for automation is given it will be very useful to proceed further. Though In thingworkx the JavaScript is not in Easy Format to Code as some Loop statement snippets are not allowed to use. So, I worked with Python Coding and wrote and algorithm for only assembling the smarties in a required format. I have attached my code below.

Python Code:

```
n=0

a=[1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,
1,1,1,1,1,1,1,1,1]

while(n<(len(a)/7)):

   print('\n',a[n:n+1]*7)

   n=n+1
```

OUTPUT:

```
[1, 1, 1, 1, 1, 1, 1]
[1, 1, 1, 1, 1, 1, 1]
[1, 1, 1, 1, 1, 1, 1]
[1, 1, 1, 1, 1, 1, 1]
[1, 1, 1, 1, 1, 1, 1]
[1, 1, 1, 1, 1, 1, 1]
[1, 1, 1, 1, 1, 1, 1]
[1, 1, 1, 1, 1, 1, 1]
[1, 1, 1, 1, 1, 1, 1]
```

The pallet arrangement can be done in this order.Required values can be given in the place array index to get the exact sDesign.