Material Sorter, Project 3.3.1
Tom Nguyen and Kristin Ottofy
Winter 2013 – 2014
POE Training
January 16, 2014

Table of Contents

Testing 3
Brainstorming Idea 1 4
Brainstorming Idea 2 4
Brainstorming Idea 3 5
Brainstorming Idea 4 5
Design Matrix 6
Final Design Solution 6
Design Modification 7
Final Design 8
Reflection 9
References 10
Conclusions 11

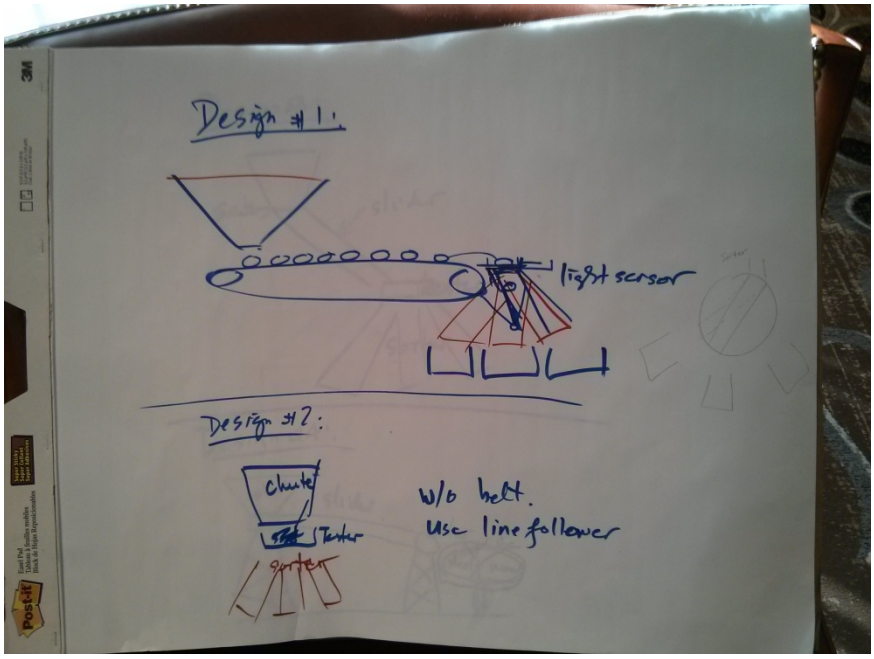
Testing

Light Sensor
Wood 800 - 900
Plastic 500
Steel 800

Line Follower – higher value darker color
Wood 2000
Plastic 100
Steel 2600

Brainstorming Idea 1

Have a chute to place the marbles in. Slightly angle the chute to ensure they drop the correct Drop one at a time on a conveyor belt. After some testing, we have determined the line follower may be the best device to use for determining the material. We will angle the line follower slightly so that the marbles rest in the exact same position each time. A blocker (door) will hold the marble from falling too quickly into the sorting area. Once the material is determined, a servo will run a device to rotate a bar to a set position. The door will open to let the marble roll (quickly so as to not let another marble through). The marble will roll into the designated bucket on slides. On to the next one! We also tested the light sensor for testing the material. The ranges for each material were not as wide as it was with the line follower.



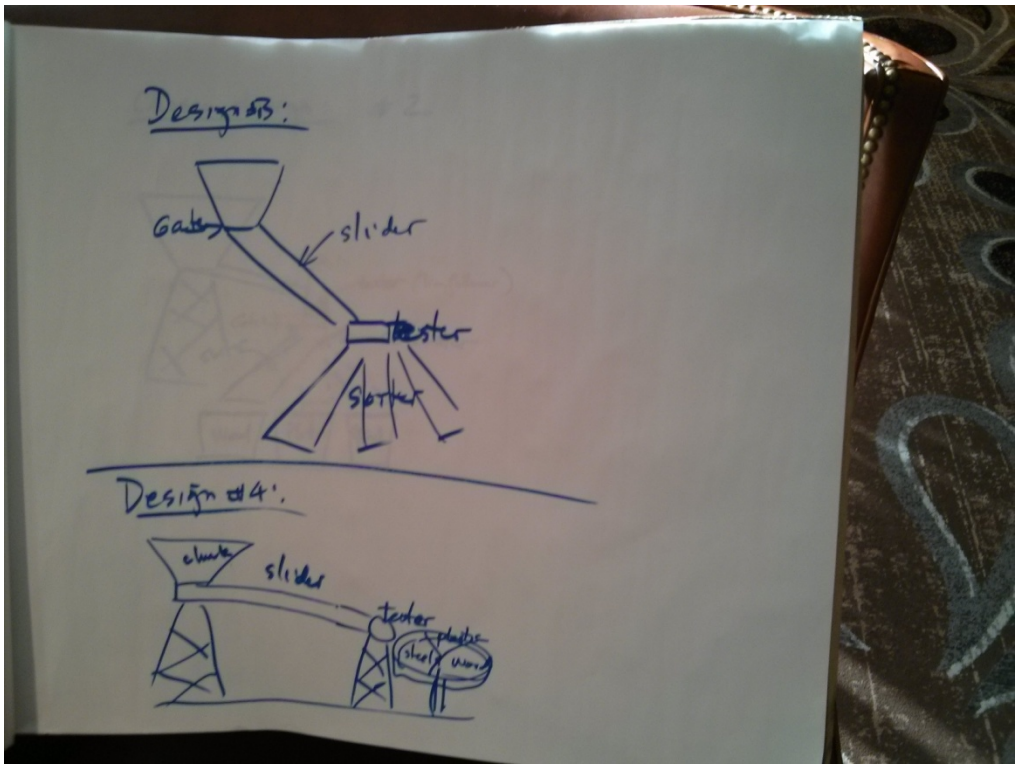
Picture 1

Brainstorming Idea 2

Test occurs immediately under the chute. The line follower is slightly angled with sides to trap marble. A door is on the lower side that will open to let the marble slide to the sorter. After the material is determined, a servo controls a slide to let the marble fall into the designated bucket. See picture 1 above.

Brainstorming Idea 3

To cut back on the number of servos and motors, we could build a slide instead of a conveyor belt to drop one marble at a time, let it slide to the tester, and sort as stated in (1). We could have 2 servos: one to control the chute door and another to control the sorting door. These could operate at the same time.



Picture 2

Brainstorming Idea 4

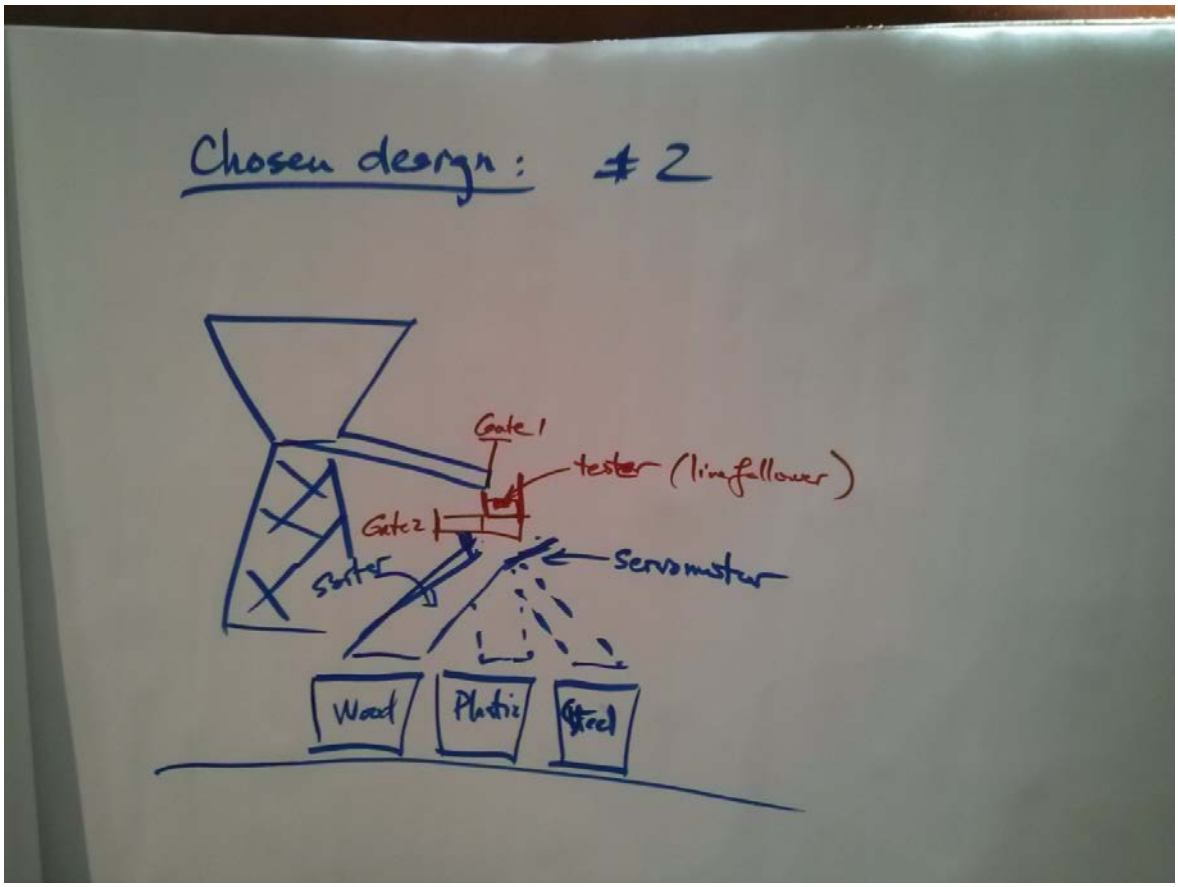
Marbles come out of chute with door one at a time. It slides down to the tester. The sorter has a rotating disc that is split into thirds, one for each material. This is less feasible than the other sorters since a servo will not rotate 360 degrees. See picture 2 bove.

Design Matrix

Design -> Objectives v	**1**	**2**	**3**	**4**
1.Easy to build	1	5	2	1
2. Practical	3	5	3	1
3. Easy to Program	1	5	2	2
4. Good lookin'	4	3	4	5
Total	9	18	11	9

1 – hardest, 5 – easiest

Final Design Solution



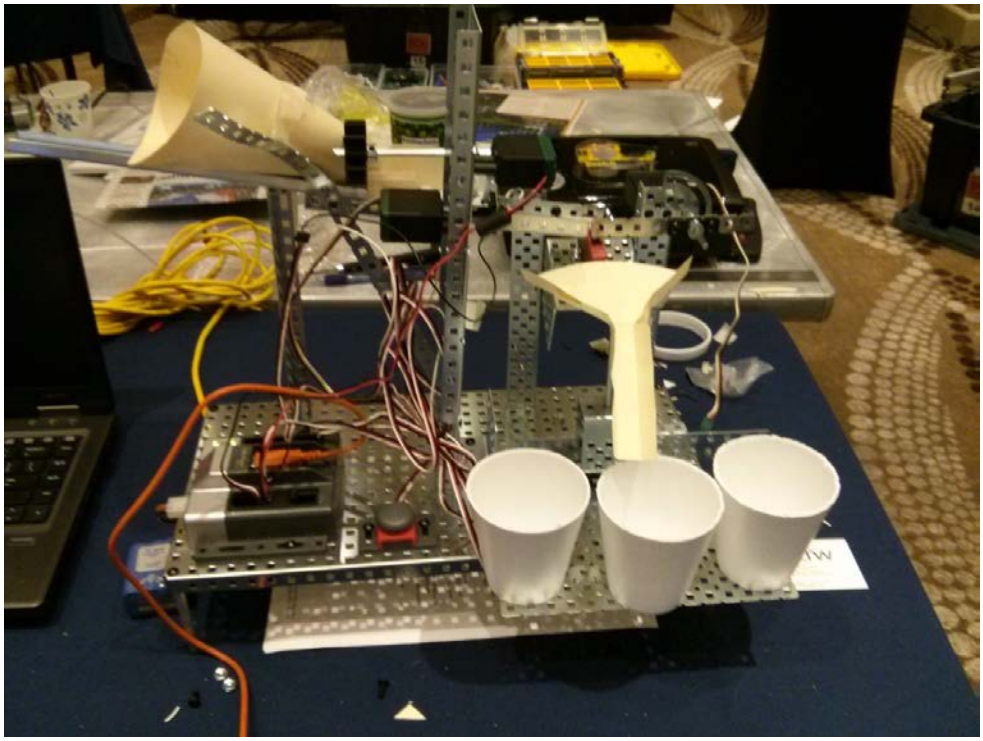
Picture 3

We chose design #2 based on the result of our decision matrix and with some modifications.

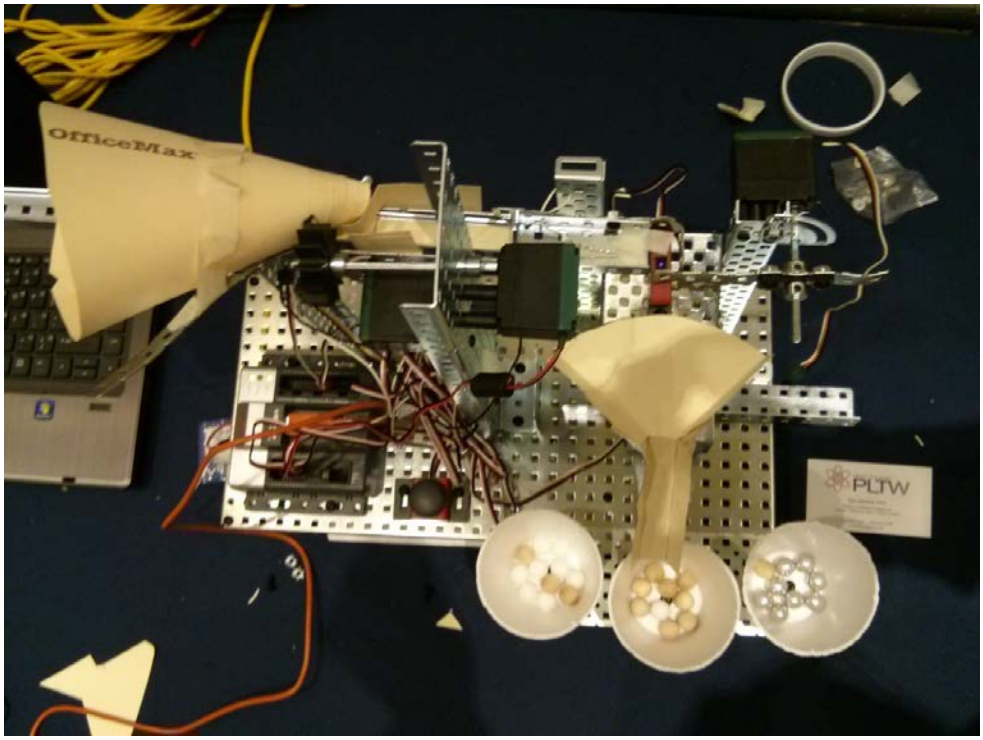
Design Modification

2. **Conductivity test:** We had much trouble to get the good readings to consistently distinguish between wood and aluminum materials. So with some suggestions from the master teacher, we incorporated the conductivity test at the beginning of the sorting sequence to quickly identify the metal object and possibly skip the line follower test completely.
3. **Industrial shaker:** Gravity feed alone was not sufficient to guarantee the continuous feed of material into the tester. The shaker was installed to overcome this challenge.

Final Design



Picture 4



Picture 5

Reflection

Our design accomplished the all of our objectives very well. It's compact, easy to build, practical, easy to program and good looking. We could have incorporated the conductivity test at the very beginning like other design to be even more efficient. We could not achieve perfection partly due to the quality of the electronic equipments used in the building of the machine. For example, the connection fit between the axle and the servo motor has lots of play so the gate could not operate to feed consistently, the line follower sensor does not provide precise reading of the colors. We struggle for a while to get the material feeder to operate properly but could not achieve the objective until we installed the shaker, the servo motors acted up sometimes. As seen in picture 5 above, the drawbacks result in some mistakes in the sorting of the materials. However, the conductivity test worked very well. The best part is the programming, Kristin is an expert programmer and she did not take any chances. Her program improves the efficiency of the entire operation and the accuracy of the outcome as much as possible. Overall, we are very satisfied with the design and the construction of the machine and did not want to take this apart.

References

We did not use any references due to the time constraint and we felt very comfortable with our brainstorming and design from the get go.

Conclusions

1. What was the most challenging aspect of this design problem?

   The most challenging is the programming to make this machine operate efficiently and we think we have successfully overcome this challenge.

2. What are some creative changes that you would make to the design solution if you could start over?

   We can incorporate the following:

   - The conductivity test at the first gate when the material is fed into the machine.
   - Included the shaker from the beginning.