



Asian Institute of Technology-AIT
AIT CENTER IN VIETNAM-AITCV

Project 2

COIN SORTER MACHINE

Design and Development

Team members

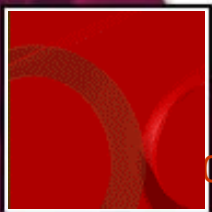
Nguyen Duy Duong

Duong Thanh Trung

Bui Trung Thanh

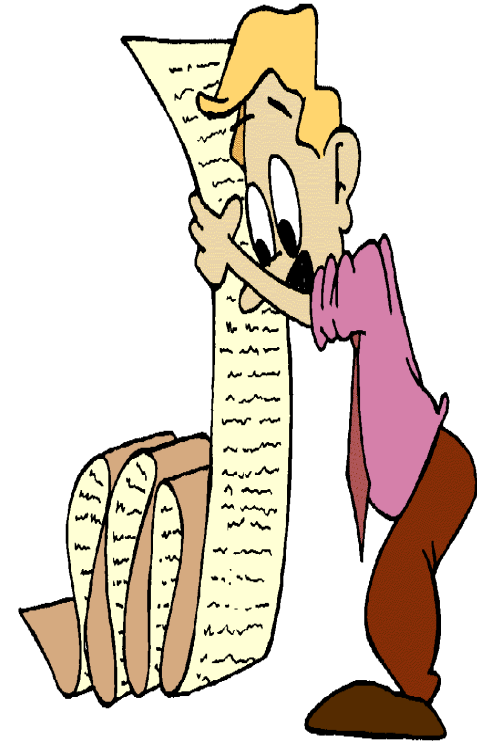
Le Viet Anh

Le Sy Trung



Outline

- **General of Phase 1**
- **Overview of Phase 2**
- **Product Architecture**
- **Product Design**
- **Make Prototype**
- **Conclusion**
- **Ten steps and product demo**



Define customer needs

1. Business Opportunities

- ◆ Vietnamese government launch new new type of money: Polymer and Coin since 1st Jan 2004
- ◆ Vietnamese Coin has 5 types
- ◆ Shop owners require a machine to sort coins



Define customer needs

2. Business Target

- ◆ **Name of Product: Coin Sorter Machine Machine**
- ◆ **Market segment: Big shops and supermarket**
- ◆ **Business goals: Products will be introduced in April. 2004**
- ◆ **Estimate sale volume: 3000-5000 units units**



Define customer needs

1. Method of define Customer needs

- ◆ Face to face interview
- ◆ Number of interviewee: 30 shop owners owners including 6 lead users
- ◆ Place of interview: Hanoi (15), and HCMC (15)
- ◆ Customer survey form



Define customer needs

#	Customer Statement	Interpreted Needs
1	I'd like to have a C.S machine is small	C.S dimensions are small
3	I'd like a machine is light weight	C.S is light weight
4	I'd like a machine can sort all my coins at the end of a day business	C.S can sort large numbers of coins
6	I'd like a machine can sort properly coin types	C.S sorts coin exactly
9	I'd like a machine very easy to use to all my staffs	C.S is easy to use
13	I'd like a machine make me reduce stress when use it	C.S has music player

Define customer needs

1. Organize C.Ns and Rate Important needs

Hierarchy	Customer Needs	Imp.
Basic functions	C.S dimentions are small	10
	C.S is light weight	9
	C.S can sort large number of coins	10
	C.S sorts coin exactly	10
	C.S is easy to use	10
Extra function	C.S has music player	8
Upgrade function	Has motor driven sort screen	8

Establish product specification

Metric no.	Need no	Metric	Imp	Units
1	1	Dimension	9	cm*cm*cm
3	3	Total weight	9	Gram
4	4	Sorting coins per time	9	Coin/ s
6	6	Tolerance	10	Mm
7	7	Easy to operation	9	Rank(1...5)
11	13	Music device	9	Number
12	15	Motor driven	8	Number

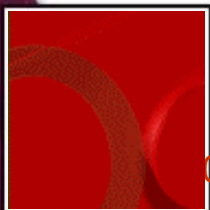
Establish product Specification

Metrics no	Need No.	Metrics	Imp	Units	Marginal value	Ideal value
1	1	dimension	9	cm*cm*cm	<35*35*40	<20*20*24
3	3	Total weight	9	gram	<2000	<1000
4	4	sorting coins per time	9	coin/s	>28	>50
6	6	Tolerance	10	mm	<5	<3
7	7	Easy to operation	9	rank	>3	>3
11	13	Music device	9	No	>1	>1

Establish product Specification

House of Quality for coin sorter

		Dimension	Total weight	sorting coin per time	tolerance	easy to operating	music device	Importance	Competitor Product	Our Product future	Rate of Improvement	Sale Point	Raw score	Normalized Score
1	dimension are small	9 125						10	9	9	1,0	1,2	12	14
3	light weight		9 137				1 10	9	8	9	1,1	1,3	13	15
4	can sort large number of coin			9 223	1 25			10	7	10	1,4	1,5	21	25
6	sort coin exactly				9 173			10	9	10	1,1	1,5	17	19
7	easy to use			3 14	1 14	9 130	1 14	10	8	10	1,3	1,0	13	14
13	music player					1 12	9 112	8	8	9	1,1	1,2	11	12
	Total	125	137	237	212	142	137	991					87	100
	%	13	14	24	21	14	14	100						
	Measures	c*c*c	gram	coin/s	mm	rank	type							10



Establish product Specification

Cost model for coin sorter

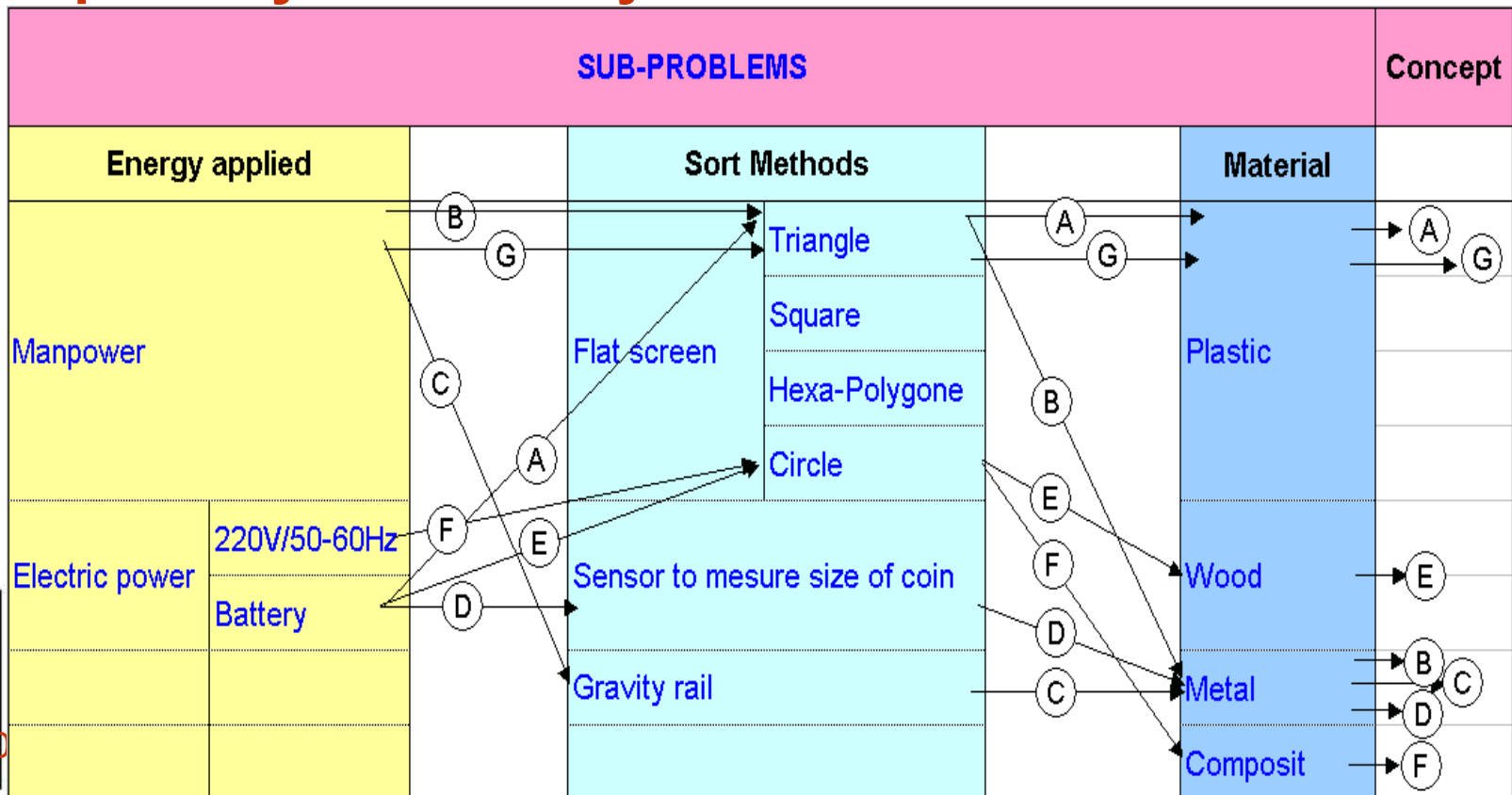
No	Components		Qty/un it	(Dong/ each)	(Total Dong)
1	Basic product	Coin sorter	5	60,000	300,000
2		Coin tray	1	50,000	50,000
3		Detecting lamp	1	15,000	15,000
4		Music	1	5,000	5,000
5	Upgrade product	Sensor counter	5	30,000	150,000
6		Digital indicator	1	50,000	50,000
7		Motor	1	100,000	100,000
8		Controller	1	50,000	50,000
	Total		16	360,000	720,000
	Overhead cost		15%	57,600	108,000
	Production cost		25%	90,000	180,000
				507,600	1,008,000

Concept Generation.

Clarify the problem.

Search externally and Internally.

Explore systematically.



Concept Selection.

Concept screening.

Base on the results of key needs and HOQ, we can screen these concepts to narrow them.

Concept scoring.

Base on the results of concept screening table. We will make the score table to select the best solution.

Selection criteria	Weight	Concepts							
		Sol.A		Sol. B-C-F ref.)		Sol. E		Sol. G	
		Rating	Weighted score	Rating	Weighted score	Rating	Weighted score	Rating	Weighted score
Ease of use	10	4	40	3	30	4	40	4	40
Ease of maintenance	5	4	20	3	15	4	20	4	20
Durability	10	3	30	3	30	3	30	3	30
Reliability	22	3	66	3	66	1	22	3	66
Shape	7	2	14	3	21	5	35	4	28
Weight	10	3	30	3	30	4	40	3	30
Maximum number of coin per time	8	3	24	3	24	4	32	3	24
Sorting speed	10	3	30	3	30	4	40	3	30
Total score	100	344		300		313		358	
Rank		second		fourth		third		first	
Continue?		Devolop		no		no		Develop	



Refine the specification.

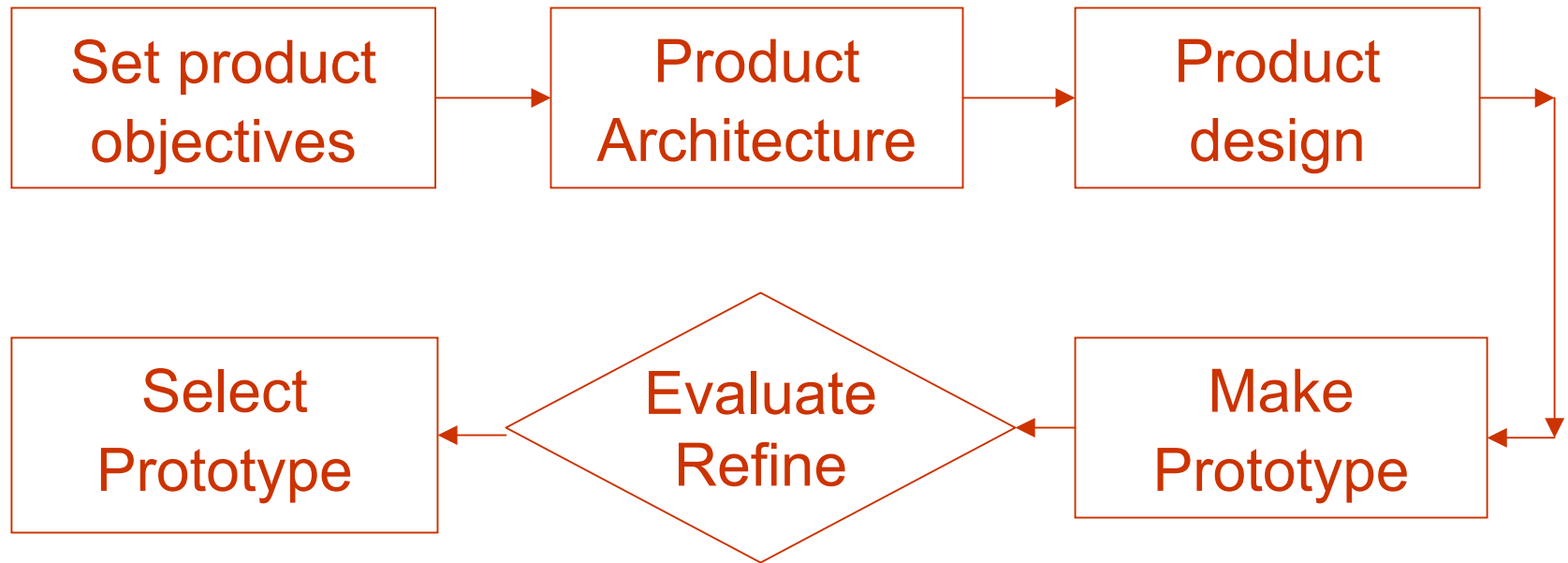
As a concept has been chosen. We refine the specification then bring out the refined specifications as follow:

Metric No	Needs No	Metric	Imp.	Unit	Value
1	1	Dimension	9	mm	<200x200x250
2	2	Material	9	Kind	Plastic
3	3	Total weight	9	Gram	<1000
4	4	Sorting coins per time	9	second	>50
5	5	Type coins can sort	9	Type	>5
6	6	Tolerance	8	Mm	<3
7	7	Ease of operation	8	(1...5)	>3
8	10	Cabinets	9	Number	>5
9	11	Indicator for each cabinets	8	Number	>1
10	12	Fake detecting lamp	9	Number	>1
11	13	Music device	9	Number	>1
12	15	Motor driven	9	Number	>1
13	9,12,14	Sensor	8	Number	>5
14	8	Maintenance	9	Time/year	<3



Product Design & Develop

Action plan



Overview

Objectives

1. Internal Objectives

- ◆ **Minimize number of parts**
- ◆ **Minimize and standardize parts type**
- ◆ **Minimize production time**
- ◆ **Minimize and simply assembly steps**
- ◆ **Upgradable and flexible product**
- ◆ **Available of materials and vendors**

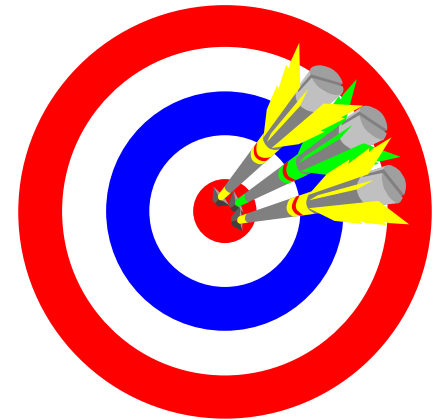


Overview

Objectives

2. External Objectives

- ◆ **Easy to use**
- ◆ **Easy to maintenance**
- ◆ **Extra function**
- ◆ **Up gradable and flexible product**



Product Architecture

Modular Architecture

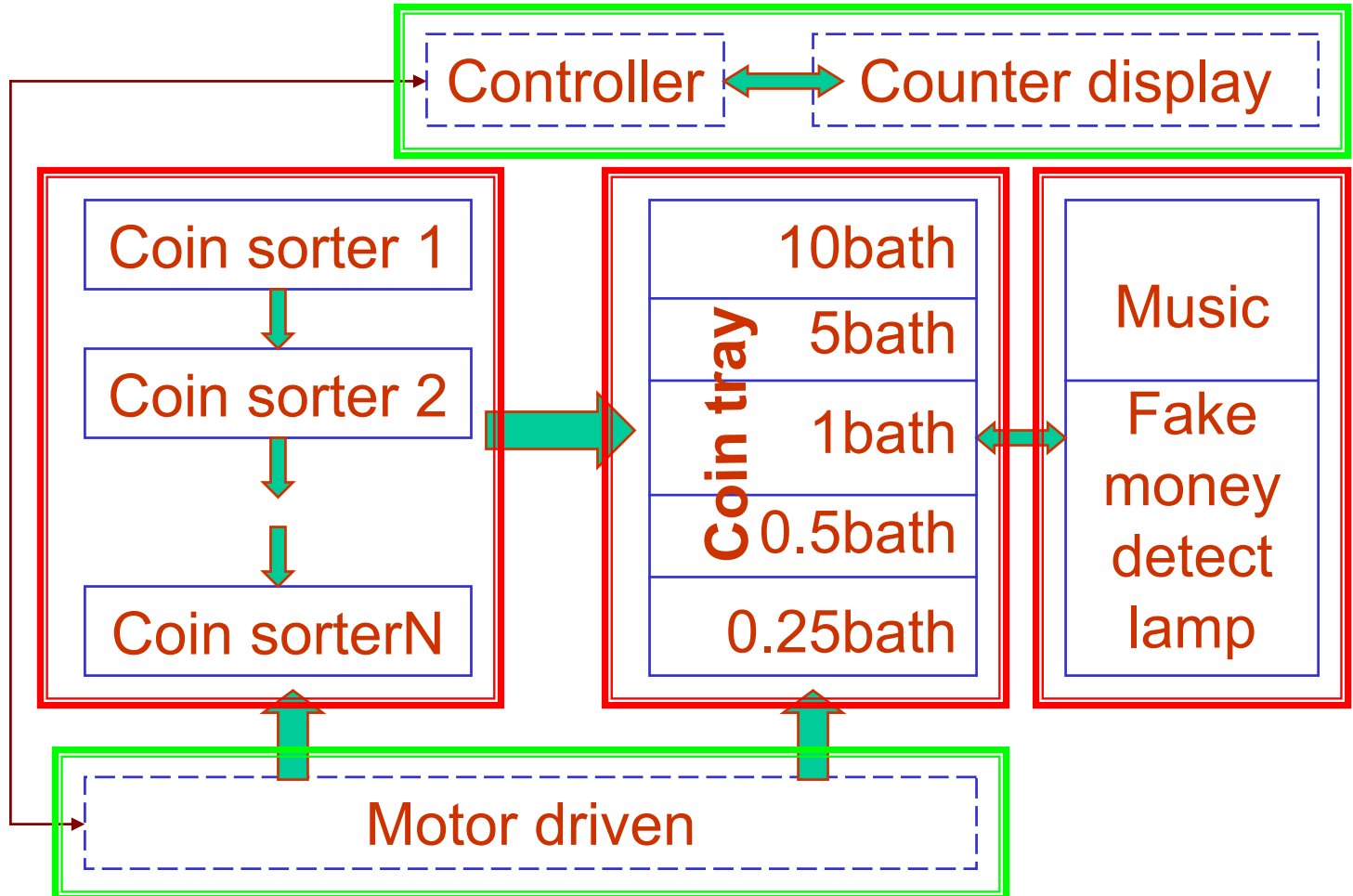
1. Modular architecture selected

- ◆ Product must combine of independent chunk
- ◆ Each chunk plays one function
- ◆ Design product with minimize of chunk interactions
- ◆ Minimize design changing effects of one chunk to other chunks
- ◆ Stabilize production processes



Product Architecture

Product Schematic and Cluster



Product design

Design components

- ◆ **Coin sorter module**
- ◆ **Coin trays module**
- ◆ **Extra-function module**
 - ◆ **Music player**
 - ◆ **Detect fake money**



Product design

Coin sorter module

- **The sieve is made from little erosive material: Stainless steel**

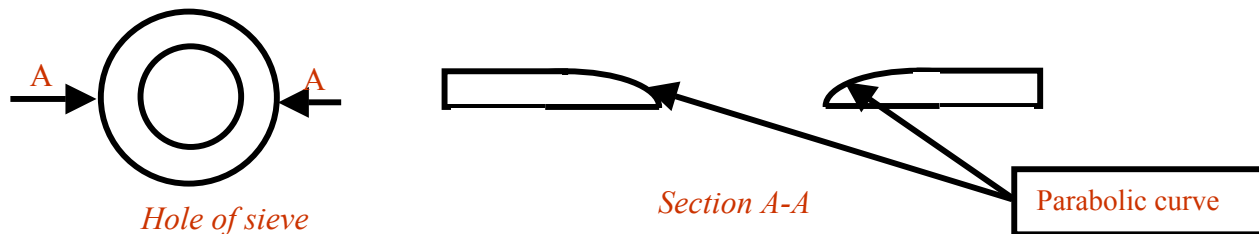


004

Product design

Coin sorter module

- The hole of sieve has to guarantee that it does not trap the smaller coins at each floor.
- Parabolic tapering of the edges can apply to optimize this effect
- A mill machine with sphere cutter for 3D surface. Since we do not have such machine, mica is best choice for our prototype



Product design

Coin sorter module

- **Sort best of 100 coins per batch and maximum for a batch is 150**
- **Testing with the most difficult case: 149 largest coins and a smaller coin**
- **Initially, 25-holes sieve was tested: three time of shaking the smaller coin passed through to the lower level**



Product design

Coin sorter module

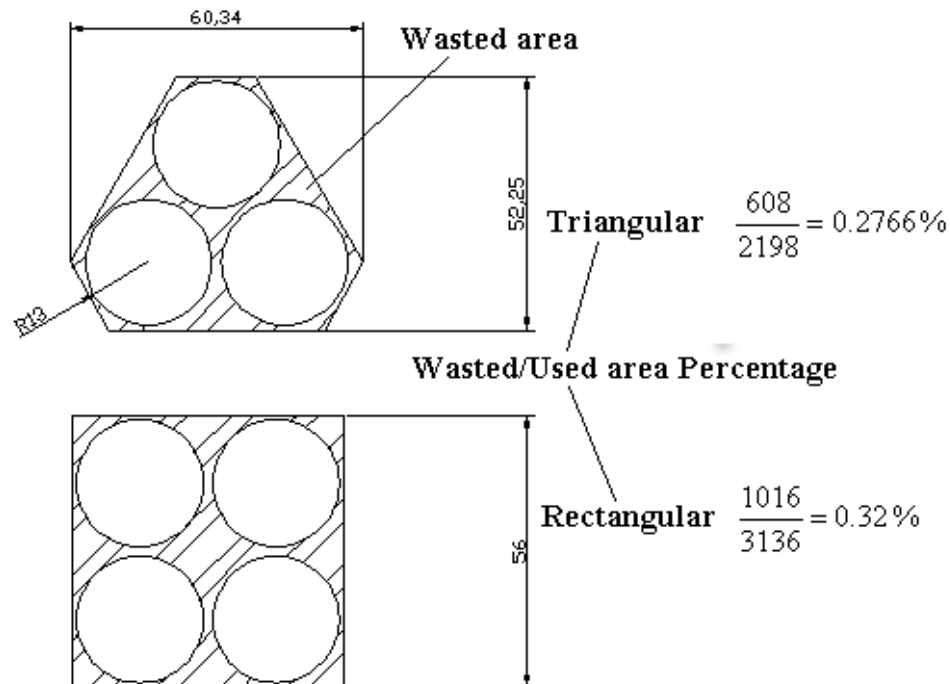
- **Since the dimension of machine has small enough for easy operation and good appearance \Rightarrow 10-hole sieve was tested**
- **Result: 4 times of shaking the smaller coin passed through in case 100 coins and 5-6 times for the case of 150 coins**
- **We decided our sieve will have 10 holes for each floor**



Product design

Coin sorter module

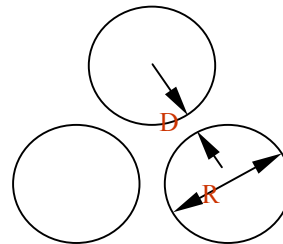
- The ratio between “buffer area” and whole surface of each floor is minimum but it still guarantees the strength of structure



Product design

Coin sorter module

No.	Sieve floor	Diameter of biggest coin through the hole (Rc-mm)	Diameter of sieve hole (R-mm)	D - Dimension (mm)
1	Highest floor	25	25.74	2.6
2	Third floor	23	23.76	2.4
3	Second floor	19	19.8	2
4	Lowest floor	17	17.84	1.8



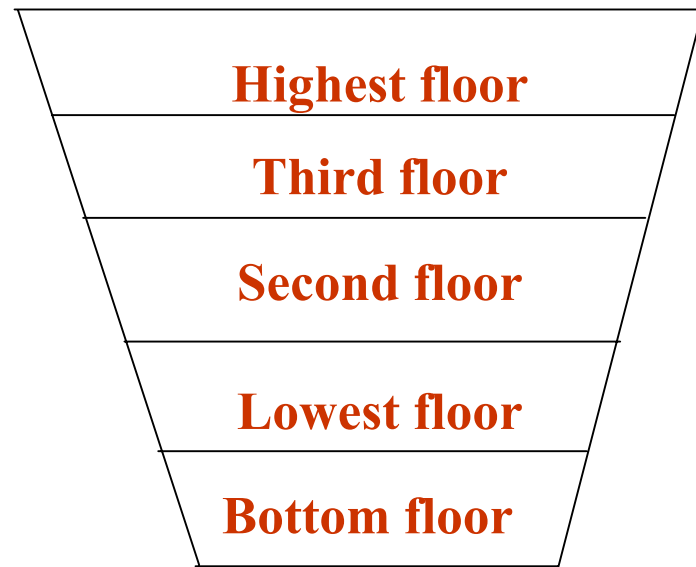
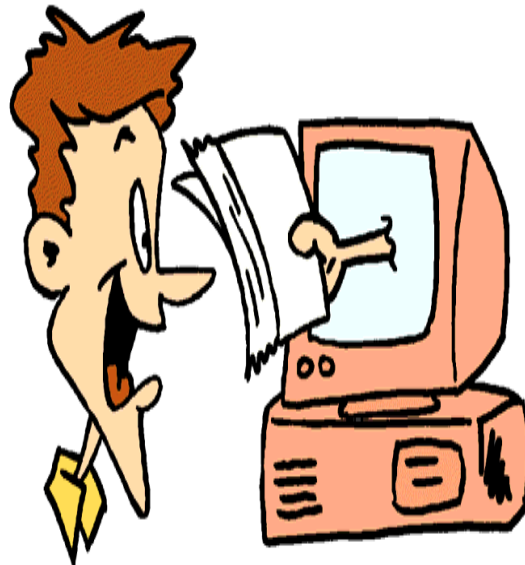
Triangular pattern



Product design

Coin sorter module

- **The coin is visible during sorting**
- **How is the appearance of this module?**



Product design

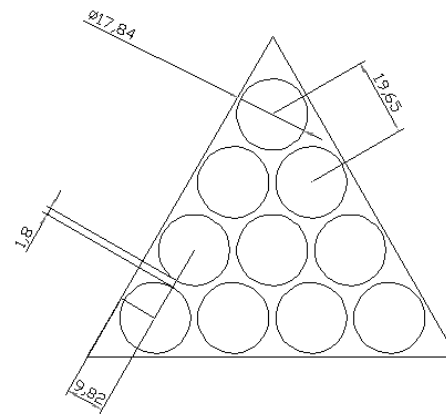
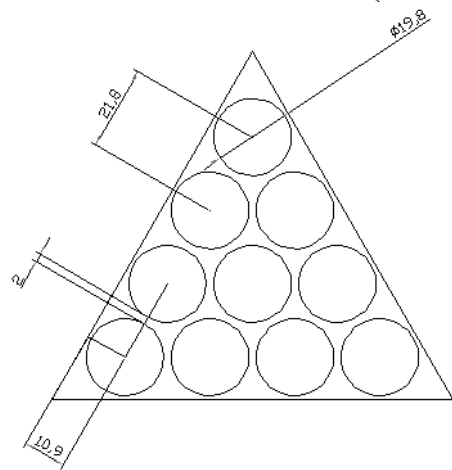
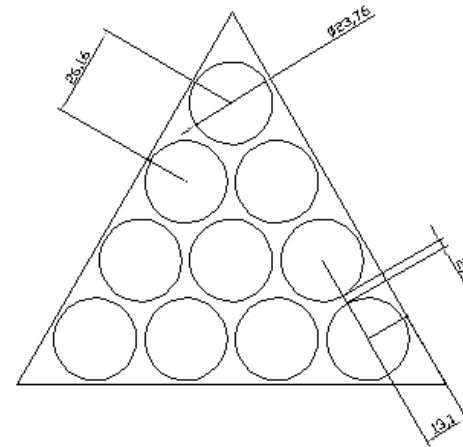
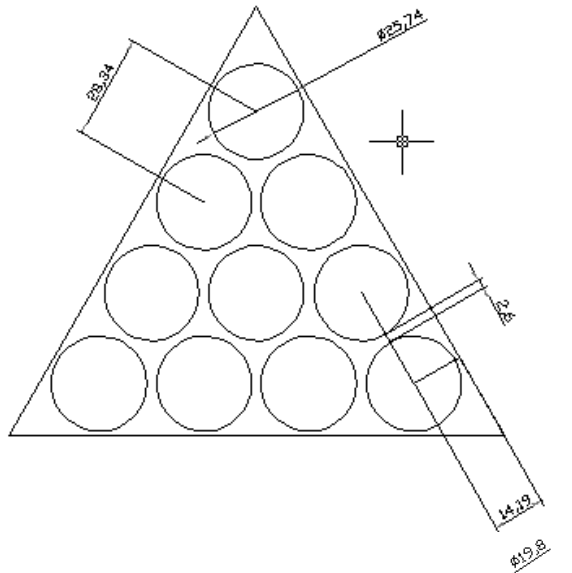
Coin sorter module

- **Screw using, symmetry design**
- **How would we get the coins out?**
- **We cut small vertical slots in the side of each level, two-coins wide and two-coins high**



Product design

Coin sorter module



Product design

Coin trays module

- **The idea:** The best way to contain separately each type of coin is some trays would be designed and placed under each level accordingly



Product design

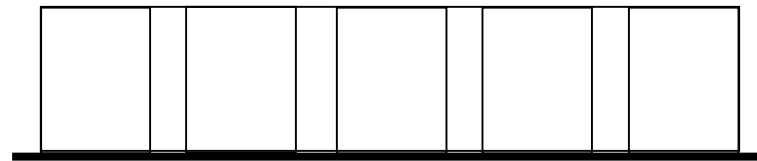
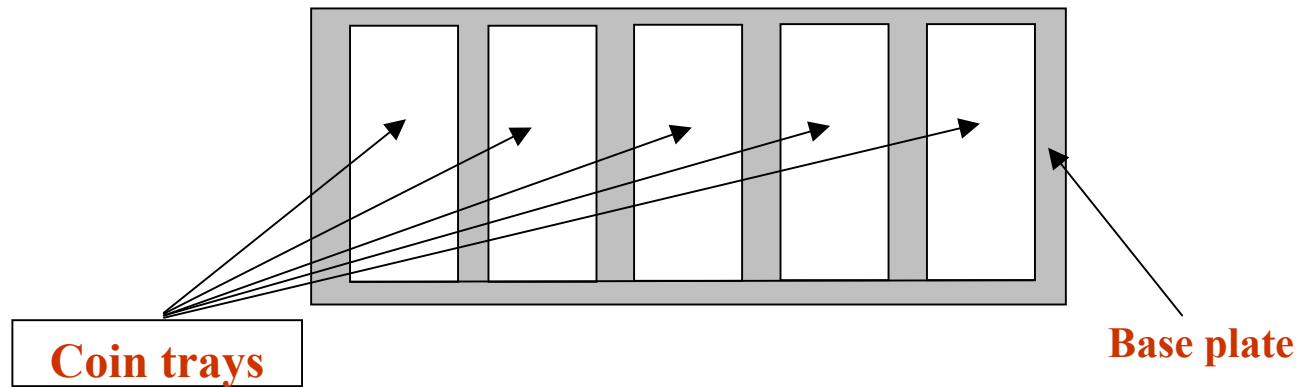
Coin trays module

- **Material:** Because this component does not request very strong whereas it needs light and aesthetic, thus mica is a best choice



Product design

Coin trays module



Product design

Bill of material

No.	Material type	Unit	Quantity	Material code	Applied function
1	Mica 5mm thick	m2	0.5	WR-01	Wall of each floor
2	Mica 3mm thick	m2	0.5	CT-01	Coin tray
3	Stainless steel 1mm thick	m2	0.5	SS-01	Sieve
4	Steel screw 10x3mm	Pcs.	50	VC-01	To connect component each others
5	Hinge	Pcs	7	JH-01	To join coin tray with coin sorter module
6	Silicon 300ml/tube	Tube	1		
7	Other accessories	Lot	1		

Product design

List of tool needing to make prototype

No.	Tool and machine name	Unit	Quantity
1	<i>Hand drilling machine: 200W 220V/50Hz</i>	Pcs	1
2	Complete of wood cutter set (range 1-20mm)	Set	1
3	Complete of metal cutter set (range 1-20mm)	Set	1
4	Complete of grind stone set (range 1-20mm)	Set	1
5	Complete of file set	Set	1
6	Table drilling machine	Pcs	1
7	Personal computer with AutoCAD 2002 software	Set	1
8	A4 Laser Printer	Pcs	1
9	Steel Saw	Pcs	1
10	Others: rule, hammer, screw driver, ...	Set	1

Making prototype

General production process flow

No.	Action step	Time	Necessary Material	Necessary Tool
1	Drawing preparation	2 days	Paper	PC, Printer
2	Material Preparation	0.5 days		
3	Making the sieve for testing	2 days	Mica	Hand drilling machine with complete of cutter
4	Redesign	1 days	Paper	PC, Printer
5	Making the final sieve	1 days	Stainless steel sheet	Table drilling machine with complete of tool, file
6	Making the around wall of the sieves	2 days	Mica	Hand drilling machine with complete of cutter, file
7	Assembling the sieve and around wall	1 days	Screw, silicon	Screw driver, hand tools
8	Making the coin tray	1 days	Mica, screw	Saw, screw driver, hand tools
9	Assembling all module	1 days	Screw, silicon	Screw driver, hand tools
10	Testing and refine	2 days		
11	Decorating	0.5 days		
SUMMATION:		14 DAYS		

Making prototype

Evaluate and refine

No.	Specification	Testing method	Value	Evaluation base on reqments in Item 2	Recommen- dation
1	Weight	Weighing without load	530 grams	Pass	No-re.
2	Maximum number of coin per one bath	Trying	150 coins	Pass	No-re.
3	Exact level	Try 30 times with random coin number and random coin type	Not wrong	Pass	No-re.
4	Speed	Try as done in exact level test	Average value: 3second for 100 coins	Pass	No-re.
5	Ease of operation	Survey from 10 classmate	Good	Pass	No-re.
6	Noise level	<i>Have not done</i>			
7	Aesthetic	Survey from 10 classmate	Not very good	Not pass	Consider in Beta prototype

Conclusion



Our mission

Design and develop a product

Coin Sorter Machine



Conclusion

•From the customer needs ⇒
Establishing specification ⇒ Concept
generation ⇒ Concept selection ⇒ Set
up product design Objectives ⇒ Product
Architecture ⇒ Product design ⇒ Make
prototype ⇒ Test and refine ⇒

Conclusion



Conclusion

- **Finally, we obtained satisfactory results. These are evidences to affirm that our idea and process are true**
- **Our prototype can be developed to become a commercial product with very much engagement.**



Thank you
Question and Answer



COIN SORTER MACHINE

DEMONSTRATION

