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Coin Sorting Machine by Mechanical Method

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Abstract - *The object of this project is to separate the different Indian coins by using sorting mechanism which separates the coins according to coin diameter. The sorting part of the design is basically mechanical as it sorts the coins through their physical size. The final output of the system is the separated coins of four denominations. This research paper covers the design and different mechanical concepts regarding mechanism of working of a coin sorting machine.*

***Key Words*: Coin sorting machine, diameter, Indian coins, mechanical sorting, accurate sorting**

1. INTRODUCTION

Generally, in the commercial transactions and in the financial transactions, large quantities of coins are required at the transaction sites or at the financial organizations. Accordingly, there are the requirements that coins be accurately sorted, and these requirements are being increased day by day.

In bank, temples, super markets coins are collected in huge quantity which is in the mixed form. Generally at such places Separation and counting is done manually. It is a tedious and monotonous job. It needs extra manpower and our valuable time. Being a manual process, it has its own limitation. It lacks accuracy.

Present date, coins are sorted on the basis of diameter and weight and using some image sensor techniques and logical controlled machines. But in modern scenario the cost of such apparatus in India is very high. To overcome this situations this machine is developed.

This machines main object is to provide a simple construction and arrangement of parts for used in connection with coin collecting tray whereby coins of different denominations introduced in bulk, sorting mechanism which will actually sort the coins and coin collecting trays which will collect the coins of different denominations according to their sizes.

2. LITERATURE SURVEY

In day today life a person uses coin often at glossary shops, supermarkets, etc. Also India is a country that has a lot of temples which has donations boxes at their premises. Hence the coin has become an integral part of transactions in today's life. To sort this high amount of coins manually is a tedious and monotonous job also it does involve human errors. For fulfillment of this of demand different types of coin sorting machines are used. They are as follows:

1) Mechanical based system
2) Image processing system

In mechanical based system, coins are separated by the physical parameters generally by weight, thickness, and diameter. Whereas image processing sorting machines scans the coins to be separated and compares with the given referenced image for sorting purpose.

Yamini Yadav, Apoorvi Sood in their paper the aim of coin recognition system is to classify high volumes of coins with high accuracy within a short time span. This paper present a comparison between various coin recognition systems in terms of their accuracy which has been proposed by various researchers based on image recognition method. The accuracy rate achieved by R.Bremananth et al was 92.43%, Adnan Khashman et al were 96.3%, Hussein R.Al-Zoubi et al was 97%, Shatrughan Modi was 97.74%, Deepika Mehta et al were 40% to 50%. [1]

Suchika Malik, Parveen Bajaj, Mukhwinder Kaur in their paper Sample Coin Recognition System using Artificial Neural Network on Static Image Dataset has developed a RGB code for loading database of coin image in MATLAB, which within preprocessing recognizes the type of coin. For this unequally spaced Fourier transform is applied. The training & testing phase of neural network with rotation invariance is applied during coin recognition. The results are displayed in the form of MSE and PSNR. [2]

3. MATERIAL SELECTION

Since the machine tray is continuously subjected to wear material should withstand it and should provide good wear resistance. Also the object of this project is to make it at low price. To fulfill both conditions mild steel was selected as a material for project.

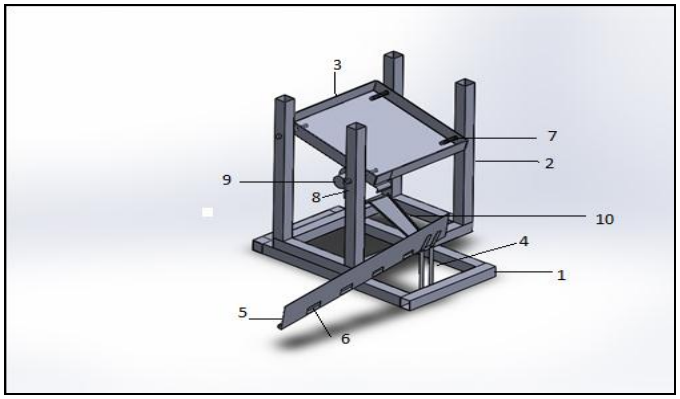

Fig -1: Coin Sorting Machine

Table -1: Parts of Coin Sorting Machine

1	Main Frame	6	Coin Guider Strip
2	Coin Collecting Tray Supporting Frame	7	Bolt
3	Coin Collecting Tray	8	Clamp
4	Coin Sorter Mechanism Supporting Strip	9	Motor
5	Coin Sorter Mechanism	10	Tin Slide

4. DESIGN CALCULATIONS

4.1 Design Calculation for Friction Angle:

Angle of friction is defined as the angle made by the inclined plane with the horizontal plane at which the body placed on an inclined plane is just on the point of moving down the plane, under the action of its own weight.

Consider a body of weight W resting on an inclined plane inclined at an angle Θ with the horizontal as shown is fig. above. The weight of the body is acting vertically downward. It can be resolved along the plane and normal to the plane as shown in fig. Component of W along the plane is W sin Θ and component of W perpendicular to the plane is W cos Θ.As the motion of the body is down the plane, the force of Friction will act up the plane. As the body is resting on an inclined plane, Normal reaction R is perpendicular to the inclined plane as shown in fig.

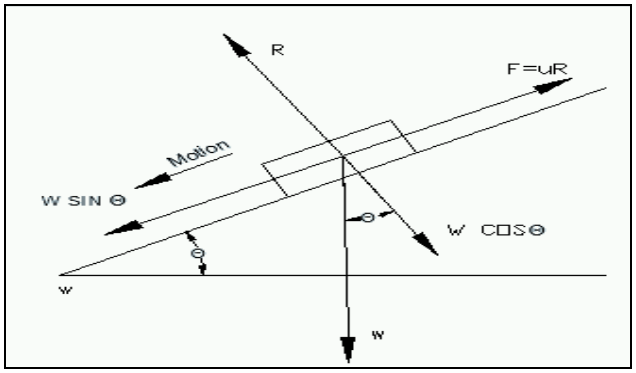

Fig -2: Friction angle calculation

In limiting equilibrium,

∑ Fx = 0 and ∑ Fy = 0

∑ Fx = 0 gives,

F - W sin Θ = 0

F = W sin Θ

μR = W sin Θ…….. (1)

∑ Fy = 0 gives

R – W cos Θ = 0

R = W cos Θ…….. (2)

Dividing (1) by (2)

$$\frac{\mu R}{R} = \frac{W \sin \Theta}{W \cos \Theta}$$

μ= tan Θ

Hence Θ gives the angle of Friction.

Angle Θ will give necessary Angle of friction for the coin to roll over the guide ways in coin sorting mechanism.

Fig. below illustrates coin sorting mechanism.

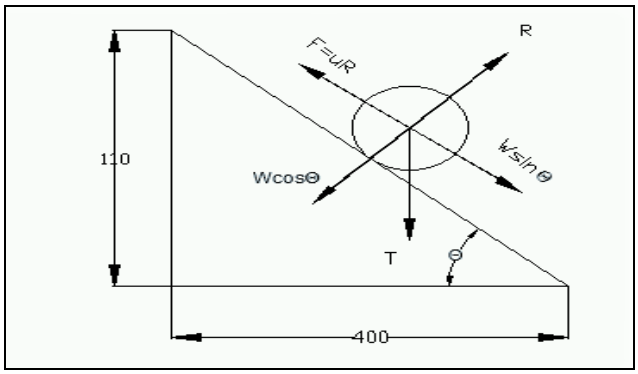

Fig -3: Friction angle calculation

When a coin rolls over guide way in corn sorting mechanism plate, normal reaction is resolved as follows

F = μ R is the force of friction acting opposite to the motion of coin

The weight W of coin acting downward can be resolved into two components W sin Θ

And W cos Θ

Sin Θ = $\frac{110}{400}$

sin Θ = 0.275

cos Θ = $\frac{400}{400}$

cos Θ = 1

Using equation (1) and (2), we calculate values of μ and R,

- μ R = W sin Θ

$$\mu = \frac{W \sin \Theta}{R}$$

$$= \frac{5.6 \text{ X } 9.81 \text{ X } 0.275}{54.936}$$

Hence coefficient of friction, μ = 0.275

- R = W cos Θ

R = W cos Θ

= 5.6 X 9.81 X 1

R = 54.936

Since μ = tan Θ

Putting value of μ

0.275 = tan Θ

This gives,

Θ = 15.77°

Therefore calculated angle of friction for above coin sorting mechanism plate with horizontal is Θ = 15.77°

5. CONCLUSIONS

After performing a number of tests and trials how the coin sorting machine performed, it can be concluded that a nearly accurate and reliable machine was created as proven by results taken. Though a few errors had occurred in certain trials, the percentage of error was minimal and negligible.

As per the said objective the machine is very cost effective and economical compared to other available in market. It was observed that in less than a minute, the machine could sort up to 50 coins. It can be concluded that the machine can be successfully used at banks, temples, supermarkets and charities.

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