Automatic Food Feeder in Cow Farm

Phapale Rushikesha[1] Wakchaure Aniketa[2] Rohit Pekalea[3] Rahane Nikhila[4] Prof.R.A.Parkhe[5]
[1,2,3,4]Student [5]Assistant Professor
[1,2,3,4,5]Department of Mechanical Engineering
[1,2,3,4,5]Pravara Rural Engineering College, Loni, SPPU, Pune, India

Abstract— Automation is the use of mechanical and electronic equipment to reduce the need for human labor. It has been used for carrying out various farm operations like automatic identification, feeding, milking, and birth detection, egg collection, exercising, barn cleaning, animal cooling, environmentally controlled housing in the livestock farms and grazing lands. The most salient characteristic of livestock farm automation system is the opportunity to tailor operations to the needs of each individual animal. This is only possible if there are subsystems capable of recognizing the animals as they interact with the automated systems. Automation saves time, requires less labor, and improves product quality and FCR, increases production, efficiency, accuracy and safety. However, automation demands high installation and repair costs; hence is more suitable for commercial & institutional farms. With the automation of farms livestock management is shifting from being an art to an app. A belt type cattle feeder having a storage hopper at one end, a movable endless belt for moving material from said hopper, and a transversely movable sweep member that passes laterally across the belt when a windrow of cattle feed has reached a preselected position in relation to the hopper, and to thereby push the material from the belt into a feed bunk or a feeding location.

Key words: Automatic Feeding, Dairy Cattle, Energy Consumption and Working Time

I. INTRODUCTION

A survey is carried out on 18 farms in Switzerland, Germany and Denmark indicates the current trends in cattle feeding an increasing no. of farms are relaying on automatic feeding to ease to a workload, save time and achieve flexibility. The farms surveyed were practical user of automatic feeding systems. There are various systems which permit the automation of feeding systems. At present rail guided field wagons are the best established in practice but conveyor belts and propelled feeders are also used. the no of feed components used different just as much as the time requirement the working time measurements of the automatic feeding systems show that by using AFS it is possible to save time and achieve greater flexibility. When the feeding is delivered with a robot or a belt feeder, the muck and possible bacteria that machinery carries in the wheels stays where it should, away from the animal feed. Similarly during cold winter spells there is no need to open larges doors and let draughts and sudden temperature changes affect the livestock. The practical problem of machinery windscreen misting when the machine is driven from hard frost to moist livestock shed is also eliminated. By programming the correct amount of feed for each group you can ensure that the previous feed has been eaten before fresh feed is delivered. This keeps the feed quality high and also eliminating the need to remove the old feed manually.

II. WORKING OF THE FEEDING SYSTEM

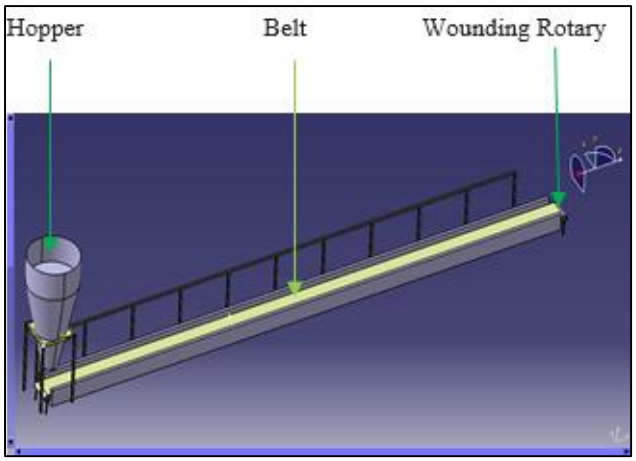

Fig. 1: CAD Model food feeding system

Before discussing the finer details of the system and automation. Let's take a quick look at the major components of a typical system and how it operates. Feeding system consist of cylindrical shape hopper having conical opening, pvc glass reinforcement belt, base structure having C shape, two wounding rotors, wire rope for pull the belt in axial direction, bidirectional servo motors, microcontroller for time adjustment and supply the power to motor.

III. WORKING STEPS OF SYSTEM

1) When the feeding timing match with controller time system will be start. Hopper valve open by screw-valve, after opening the valve motor runs in forward direction.
2) Motor is coupled with wounding rotor. Due to rotating motion of rotor belt is un-wound. Pull force act by the wire ropes form opposite end on belt.by this mechanism belt move in one point to next point then end.
3) When the belt travels point to point specific amount of food material is drop from hopper.
4) In this way one ship of food feeding is completion occur.
5) For next ship of feeding motor runs in reverse direction and belt wounding is occur on the rotor.

IV. CASE STUDY

Fig. 2: Case study of feeding system

MDF cows farm at sangamner. Case study consideration is system design to feed the food for 10 cows. Daily in two times. Capacity of hopper is 1700kg, length of belt is 14 meter. Number of food drop point is 10.

V. DESIGN CALCULATIONS

Our design is based on the above case study

A. Hopper

Mass storing capacity of hopper is 1700kg
m=1700kg
We store the maize food in the hopper,
Density of maize food is 700kg/m^3
Calculation for Volume of hopper = mass/density
= 1700/760 = 2.2368 m^3

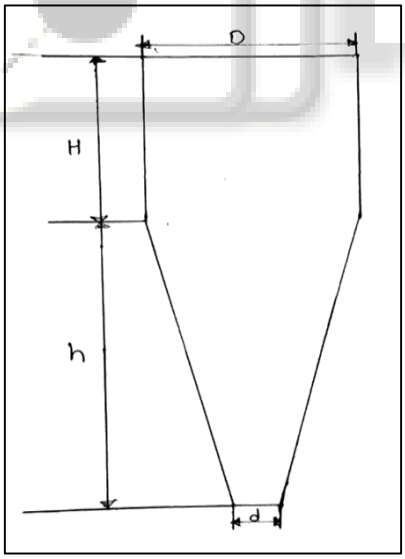

Fig 3: Hopper Nomenclature

Where,
d = opening dia. Of hopper,
h = height of conical shape,
D = dia. Of cylindrical shape,
H = height of cylindrical shape.
We required Opening dia. of conical hopper (d) = 457.3 mm.
Semi inclined angle (θ) = 30^0
h= 2+ θ/60 =2+0.5 = 2500 mm.

Volume of cylinder = $\frac{\pi}{24\tan(\theta)}$ [D^3-d^3] + $\frac{\pi}{4}$ D^2 H.

D= 2H

Where, d = 457.3 mm, θ = 30^0, put the value in above equation, we get
D= 1539.1 mm.
H = 769.5 mm.

B. Selection of motor

Power required to pull the belt (P) = F.V
f1=force due load consideration
f2=force due to friction between belt and base surface
F = f1+f2 =1200 +720 =1920 N
V= 1 m/sec.
P = 1920* 1 = 1920 watt.
Hence we selected 3 Hp motor.

C. Selection of wire rope:-

Tensile load acting on rope = 1920 N.
FOS = 4.
Selection of dia of sheave.
D= 24 d.
To determine the dia. of wire rope
Ft = 4*1920 =7680 N.
Ft = p*D*d /2
Sheave material = cast iron.
For cast iron p= 6.20 mpa.
d= 10.16 =~ 11.
Selection of wire rope = 11(6 x19).
Where, 6= strands
19=no. Of wire in each strand.

D. Selection of belt

Velocity of belt=1m/s
Width of belt=500mm

E. Advantages

1) No man power is require
2) Lower Waste of Feed.
3) Maintain Animal Health.
4) Never Miss a Feeding.
5) Reduce Costs.
6) Save Time with Automatic Feeding: Up to 6 Times per Day Using Pre-programmed Feeding Times.
7) Feeds Up to 10 Head of Cattle at a Time, More If Feeding a Calf or Smaller Animal.
8) Increase Overall Operation Efficiency and Flexibility.

VI. CONCLUSION

The paper introduces a new mechanism for feeding food in cow farm. It has advantages of being operated without manual interference, high load carrying capacity, high speed, long life. The system is simple in construction and easy to manufacture. Use of automation time will be reduce. Use in where less area is available.

REFERENCES

[1] Pezzuolo A., Magrin L., Cozzi G., Marinello F., Sartori L. Precision and efficiency of a mechanized delivery system of solid feeds for veal calves. Papers Presented at the "7th European Conference on Precision Livestock

Farming", September 15-18, 2016, Milano, Italy, pp. 465-472.
[2] Henna Hamadani "Automation in livestock farming – A technological revolution" International Journal of Advanced Research (2015), Volume 3, Issue 5, 1335-1344.
[3] Anne grothmann "automatic feeding system for dairy cattle – potential for optimization"tanicon research station art ch-8356 ettenhausen 2014.
[4] J. Miron, 1 M. Nikbachat "Lactation Performance and Feeding Behavior of Dairy Cows Supplemented Via Automatic Feeders with Soy Hullsor Barley Based Pellets", J. Dairy Sci. 87:3808–3815 American Dairy Science Association, 2015.
[5] https://www.slideshare.net/sajjad_al-amery/episode-39-hopper-design, Teknologi Zarah "Hopper Design" siti Marinda Tasrin 2008.

