AUTOMATION IN MATERIAL FILLING AND HANDLING SYSTEM IN GAYATRI PSYLLIUM INDUSRY

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Group no-21
OUTLINE

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• Objective of project
• Methodology
• Structural modeling
• Design
• Workplan
• Scope of project
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INTRODUCTION

• In this project, we find and solve problem of material filling and handling problem in Gayatri psyllium industry, Dabhi, Unjha.

• In every manufacturing industry, raw materials need to be transported from one manufacturing stage to another.

• Material handling equipment are designed such that they facilitate easy, cheap, fast and safe loading and unloading with least human interference.

• It is easier, safer, faster, more efficient and cheaper to transport materials from one processing stage to another with the aid of material handling equipment devoid of manual handling.
OBJECTIVE

• Automation in material filling and handling system of industries using belt conveyor and sensors.
• Automation with less human interference.
• Improve efficiency.
• Reduce time
METHODOLOGY

Literature Survey

Detailed Study of material filling&handling

Development of layout design

Material selection

Parameter Selection

Optimization

Final report
STRUCTURAL MODELLING
CONTINUE
CONTINUE
DESIGN

- **CONVEYOR ENERGY REQUIREMENTS**
  - Power consumption is a conveyor system operating cost.
  - Most unit handling conveyor systems are driven by a motor.
  - The electric power required to drive the system is a function of belt speed, unit load, belt weights, pulleys drive mechanism, length of belt conveyor, and other components.

- **EFFECTIVE BELT PULL**

  For roller belt

  \[ T_e = F_r L (W_m + 2W_b + R_t C_t + R_p + C_p + R_i C_i) + (W_m)h) / F_t \]

  \[ \therefore T_e = \frac{0.075 \times 1 \times (5 + (2 + 4) + (0.3 \times 16) + 0 + 0 + 0) + (5)0}{0.85} \]

  \[ \therefore T_e = 1.57 \text{ N/m} \]
For roller belt

\[ T_e = F_r L \left( W_m + 2W_b + R_t C_t + R_p + C_p + R_i C_i \right) + (W_m)h \} / F_t \]

\[ \therefore T_e = \left\{ 0.075 \times 1 \left( 5 + (2 + 4) + (0.3 \times 16) + 0 + 0 + 0 \right) + (50) \right\} / 0.85 \]

\[ \therefore T_e = 1.57 \text{ N/m} \]

Where,

- \( T_e \) = Effective belt pull (kg)
- \( L \) = Length of conveyor (m) = 1m
- \( W_m \) = Weight of unit load (kg/m) = 5kg/m
- \( W_b \) = Weight of belt (kg/m)
- \( R_t \) = Unit weight of carrying roller less shaft (kg) = 0.3kg
- \( R_p \) = Unit weight of pressure roller less shaft (kg) = 0
CONTINUE

\[ R_i = \text{Unit weight of return roller less shaft (kg)} = 0 \]

\[ C_t = \text{No of carrying rollers per meter} = 16 \]

\[ C_p = \text{No of pressure rollers per meter} = 0 \]

\[ C_i = \text{No of return roller per meter} = 0 \]

\[ h = \text{Net change in elevation (m)} = 0 \]

- The unit load weight is determined by the no of loads on conveyor.

\[ W_m = \text{No of loads on conveyor} \times \frac{\text{weight}}{\text{load}} \]

- Drive pulley forces
  - The drive pulley moves the belt by friction between two the amount of power loss from the pulley to belt is consider minor because forces \( T_1 \) and \( T_2 \) are designed to prevent slippage between pulley and belt.

- The relationship between \( T_1 \) & \( T_2 \) is

\[ T_2 = K_2 \cdot T_e \]
\[ T_1 = K_1 \cdot T_e \]

Where, \( K_1 = \frac{c}{c-1} = \frac{2.49}{2.49-1} = 1.67 \)

\[ C = e^p \left( \frac{\pi}{180} f_a \right) = 2.49 \]

\( f = 0.25 \) for bare steel pulley

\( a = \text{Arc of contact between belt & pulley} = 210^\circ \)

\[ K_2 = \frac{1}{c} - 1 = \frac{1}{2.49} - 1 = 0.67 \]

\[ \therefore T_2 = 0.67 \times 1.57 = 1.05 \frac{N}{m} \]

\[ \therefore T_1 = 1.67 \times 1.57 = 2.62 \frac{N}{m} \]
The torque requirement at the drive pulley to move the belt is

\[ \text{Torque} = T_e \times \text{drive pulley diameter (m)} \]

\[ = 1.57 \times 0.10 \]

\[ = 0.157 \text{ N.m} \]

Angular velocity

\[ V = \text{Velocity of belt} = 0.06 \text{ m/s} = \frac{\pi DN}{60} \]

\[ \therefore V = \frac{V \times 60}{\pi \times D} \]

\[ = \frac{0.06 \times 60}{3.14 \times 0.1} \]

\[ = 11.46 \]

\[ W_{dp \ (r.p.m)} = 3.187 \times \frac{\text{belt speed}}{\text{drive pulley diameter}} \]

\[ = 3.187 \times 11.46 / 0.1 \]

\[ = 437.42 \]
Power required at the pulley shaft

\[ P_{dp} = \frac{W_{dp} + \text{Torque}}{63025 \times 0.95} \]

\[ = \frac{437.92 + 0.157}{63025 \times 0.95} \]

\[ = 6.94 \times 10^{-3} \text{ KW} \]

\[ = 6.94 \text{ W} \]

\[ \approx 7 \text{ W} \]
COMPONENTS

- Belt conveyor
- Hopper
- DC motor
- Microcontroller
- Transformer
- Buzzer alarm
Belt Conveyor

- A Conveyor Belt is the carrying medium of automatic bottle filling machine.
- The powered Pulley is called drive pulley and the unpowered pulley is called idler pulley.
- In the Box filling machine generally the rubber conveyor belt is used for convey the bottle.
- The Belt looped around each of the rollers which are powered by an Electrical DC Motor.
Belt

Length Of Belt : 180 cm
Width : 16 cm
Material : Resin

Roller

No. Of Rollers : 2
DC MOTOR

- A DC motor is any of the class of electrical machines that converts the direct current electric power into mechanical power.
- It produces rotary motion; a linear motor directly produces force and motion in a straight line.
- In Box filling machine, the DC motor is used to rotate the conveyor belt at a desired speed.

Voltage = 12V
Rpm = 30 & 50
HOPPER

- A container for a loose bulk material such as grain, rock, or rubbish, typically one that tapers downward and is able to discharge its contents at the bottom.
- Upper cross-section=29cm x 29cm
- Lower cross section=7.5cm x 7.5cm
- Height= 20cm
MICROCONTROLLER

• Company name = ATMEL
• Model type = 8051 family
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SCOPE OF PROJECT

• In food industries.
• In material handling industries.
• Agricultural product industries.
• Dairy products.
CONCLUSION

- Using the designed values above, a belt conveyor system with 2 roll idlers can be developed for conveying material box efficiently without belt slippage and fatalities.
- Racgin belt with the specifications above will sufficiently convey the material box.
- The belt conveyor system is designed with high degree of automation, loading, movement and unloading efficiency.
- It is also very flexible, safe, with low initial, operational and maintenance cost while eliminating repetitive short distance movement in the manufacturing industry.
- By use of level sensor in hopper, we set an alarm when hopper is empty.
REFERENCES


[8] Tanaka Daisuke, “Development of low-cost filling system indispensable to beverage industry (2012)”.
THANK YOU