Positioning of Conveyor and Loadcell Measurement

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Abstract

Most of the conveyor applications are run at constant speed or at variable speed. It can be achieved by three various methods. They are pulse control, velocity control and network control. The position of a belt will be change when it is rotated in dangerous speed. To prevent from these certain parameters are should be followed. They are side of flow direction, motor position and motor terminal box. The input voltage given to the conveyor may be a DC/AC supply. In industries they are mostly preferred AC voltage motors. In case of single direction rotating the motor, it consumes maximum 1W to 200 W. By the depending on motors connected its power consumption will be varied.

Keywords- AC Motor, Arduino, Loadcell, Encoder and Alarming Unit

I. INTRODUCTION

The conveyor belt is carrying medium of a belt conveyor system. It consists of two or more pulleys with an endless loop of carrying medium. Anyone or both of the pulleys are powered, moving the belt and the material on the belt will move forward. The powered pulley is called the drive pulley while the unpowered pulley is called idler pulley. There are two main industrial classes of belt conveyors and those in general bulk material handling such as those used to transport large volumes of resources and agricultural materials, such as grain, salt, coal, ore, sand, overburden and more.

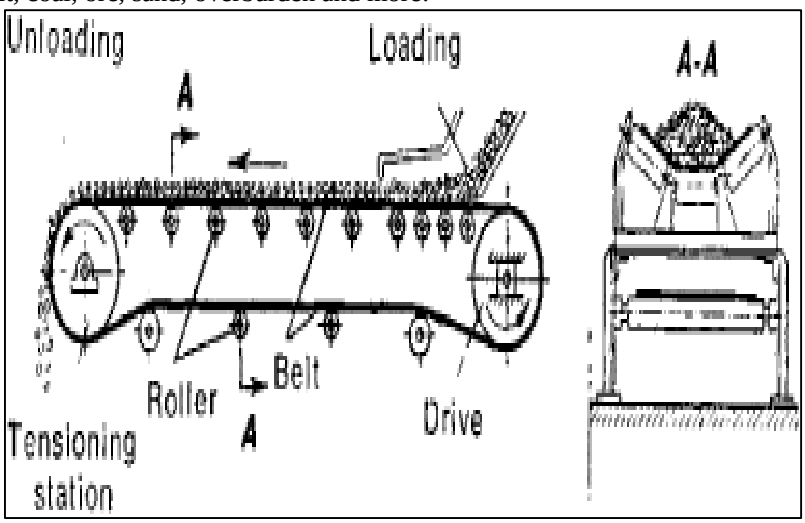


Fig. 1: Conveyor Setup

A single shaft runs on below rollers by which running the length of the conveyor. Then an elastic polyurethane o-ring belt runs from a spool on the powered shaft to each roller. The rotation of the rollers pushes the product along the conveyor. The shaft is driven by an electrical motor that is controlled by an electronic PLC controller.

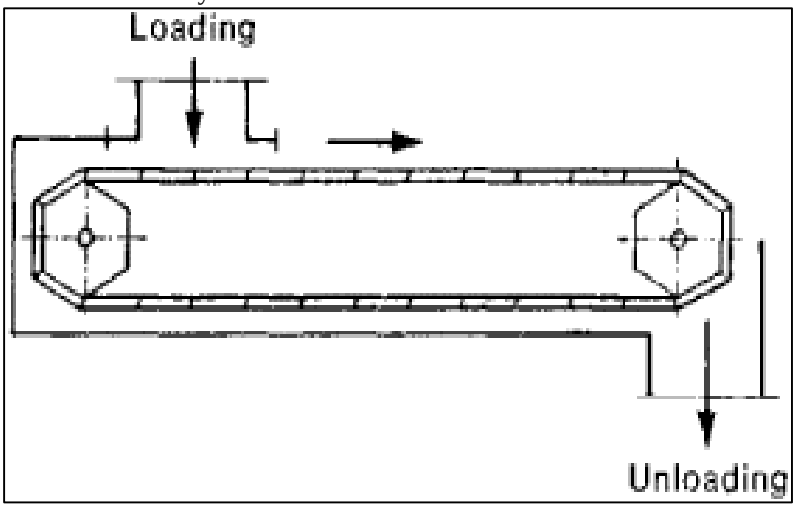


Fig. 2: Loading and Unloading Diagram of Conveyor

II. PROPOSED SYSTEM

Our aim of the project is to read the weight travels on the conveyor belt by using loadcell and its amplifier circuit. The length of the conveyor is designed by engineers and the depending on feeding tank presenting area. Materials falling from the hopper is made to fall freely in the conveyor belt, by slowly rotating the speed of the motor the material will be dispatched in the collecting tank. Loadcell will be fitted in the center of the belt it can able to measure up to 8cm distance. So materials when crossing that area the weight can be measured.

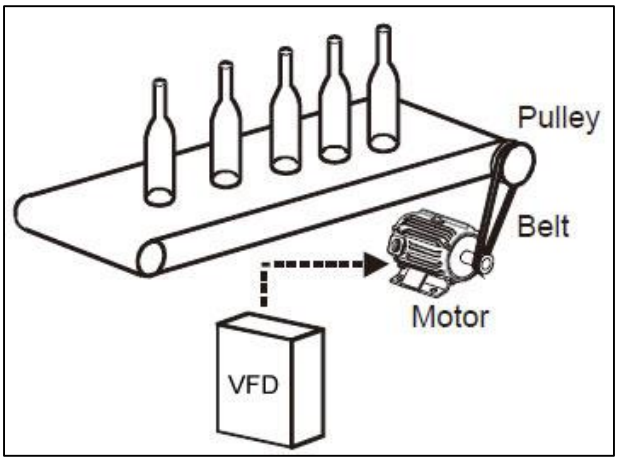


Fig. 3: Overview Layout of Our Project

A. Selection of Motor

Here the designer will select a 15 HP motor with a gearbox yielding a belt speed of 100 fpm at 460volts/3 phase/60 Hz. While running on a VFD at 30 Hz, this motor will be equivalent to a 7.1 HP motor. And the Designer should select an appropriate VFD for the 15 HP belt drive motor. The reason is for that resonant frequencies can occur on the line between the VFD and the motor causing voltage spike and damaged motor.

B. Calculation of Speed

The standard speed for most unit handling conveyors is 65 FPM and this is the average speed a person walks when he's carrying a 50 lb. box. In other speeds, both faster and slower than 65 FPM, are also adjustable.

1) Belt Tension

The belt of the conveyor has always had an experience with tensile load due to the rotation of the electric drive, weight of the conveyed materials. The belt tension at steady state can be calculated as:

$Tb = 1.37* f * L*g*[2* mi + (2 * mb+ mm)*\cos(\delta)] + (H*g*mm)$

Where,

L = Conveyor length in meters. Conveyor length is approximately half of the total belt length.
δ = Inclination angle of the conveyor in Degree.
g = Acceleration due to gravity = 9.81 m/sec2
mi = Load due to the idlers in Kg/m.
Tb is in Newton.
f = Coefficient of friction
H = vertical height of the conveyor in meters.
MB = Load due to belt in Kg/m.
mm = Load due to the conveyed materials in Kg/m.
Load due to idlers (mi):
This can be calculated as below:
mi = (mass of a set of idlers) / (idlers spacing)

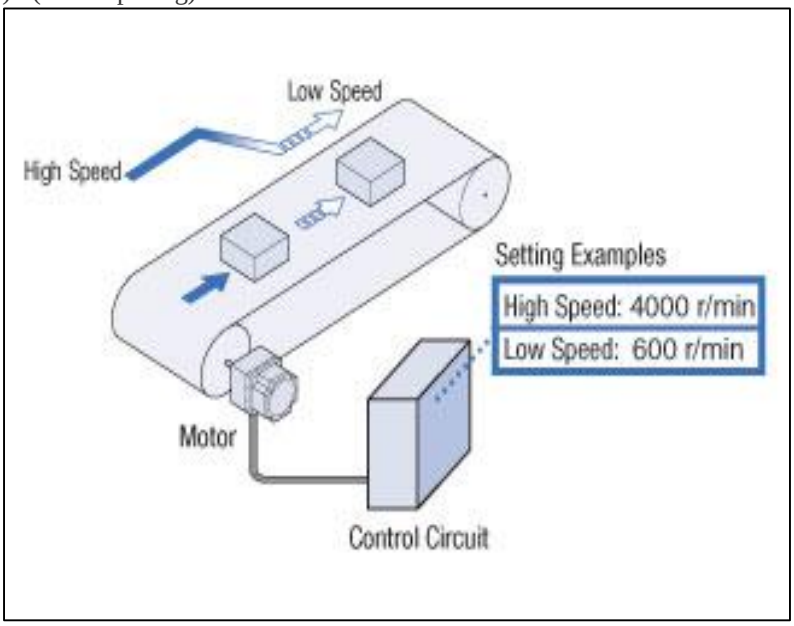
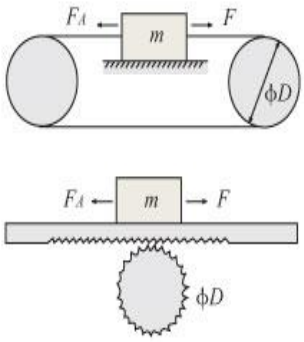


Fig. 4: Speed Calculation for Conveyor

C. Calculation of Belt

$$T_L = \frac{F}{2\pi\eta} \times \frac{\pi D}{i} = \frac{FD}{2\eta i}$$

$$F = F_A + mg(\sin\theta + \mu\cos\theta)$$



F : Force of moving direction
μ_0 : Internal friction coefficient of preload nut (0.1~0.3)
η : Efficiency (0.85~0.95)
i : Gear ratio (This is the gear ratio of the mechanism and not the gear ratio of the Oriental Motor's gearhead you are selecting.)
P_B : Ball screw lead
F_A : External force
m : Total mass of the table and load
μ : Friction coefficient of sliding surface (0.05)
θ : Tilt angle [deg]
D : Final pulley diameter
g : Gravitational acceleration

Fig. 5: Calculation of Belt Thickness

D. VFD

A VFD is a type of motor controller that drives an electric motor by varying frequency and voltage which applied to the motor. The working principle of VFD is divided into multiple stages. Here the first stage is converter circuit, which consists of six diodes and they allow current to flow in one direction. The basic control circuit of vfd is given below.

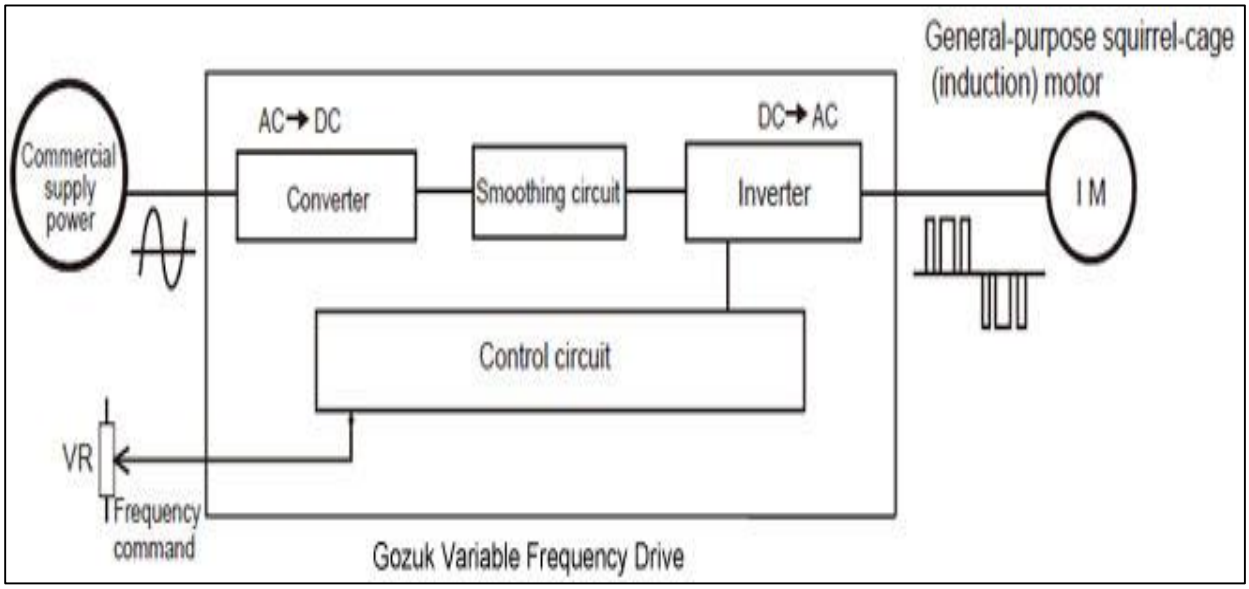


Fig. 6: Basic Control Circuit of VFD

E. VI Characteristics of Motor

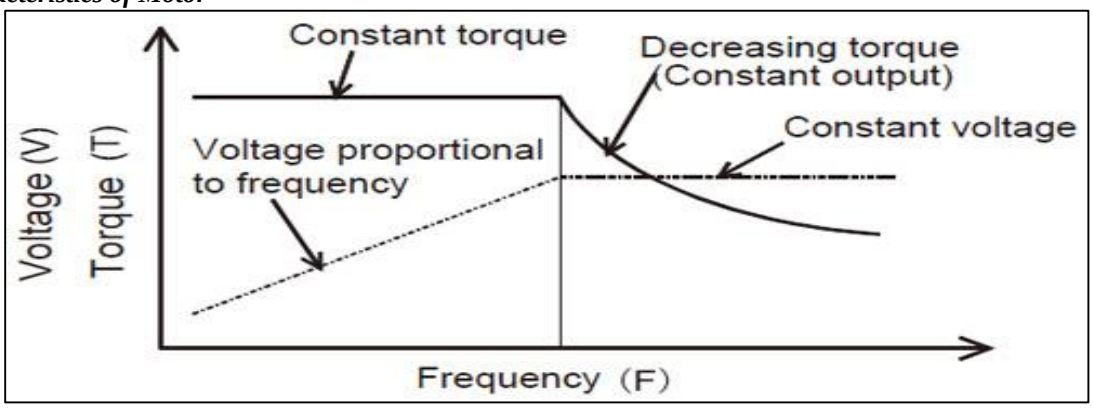


Fig. 7: Characteristics Curve of Motor

The speed of the motor is depend on load variations, if more load passed on belt is high motor torque will be high and if load passed on belt is low then the motor torque will be get reduced.

F. Experimental Setup

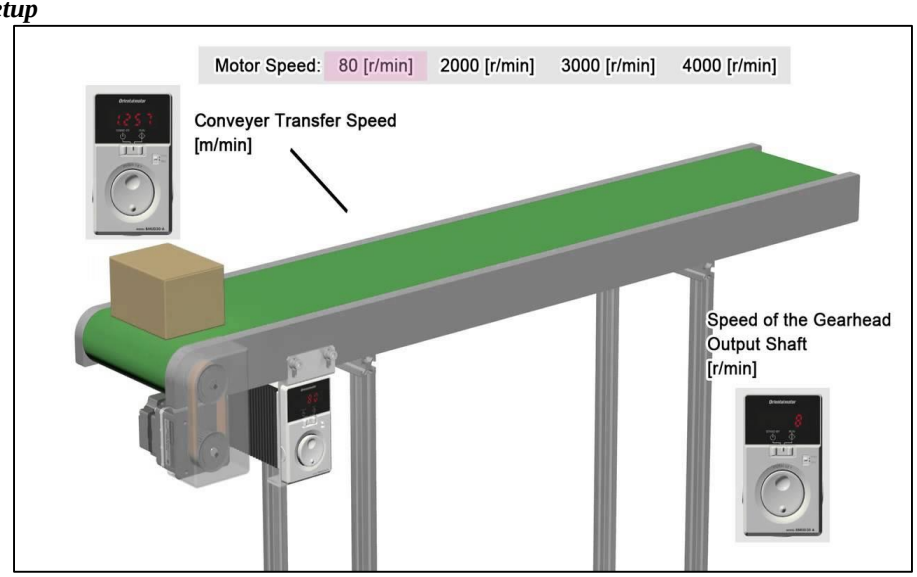


Fig. 8: Load Variation in Speed

Here the experimental setup of our project is designed graphically. The speed of the motor is varied according to the tank filling capacity duration. In case of requirement of faster to fill the tank we have to increase the speed of the motor. Obviously for slower operation motor is reduced for maximum period operation.

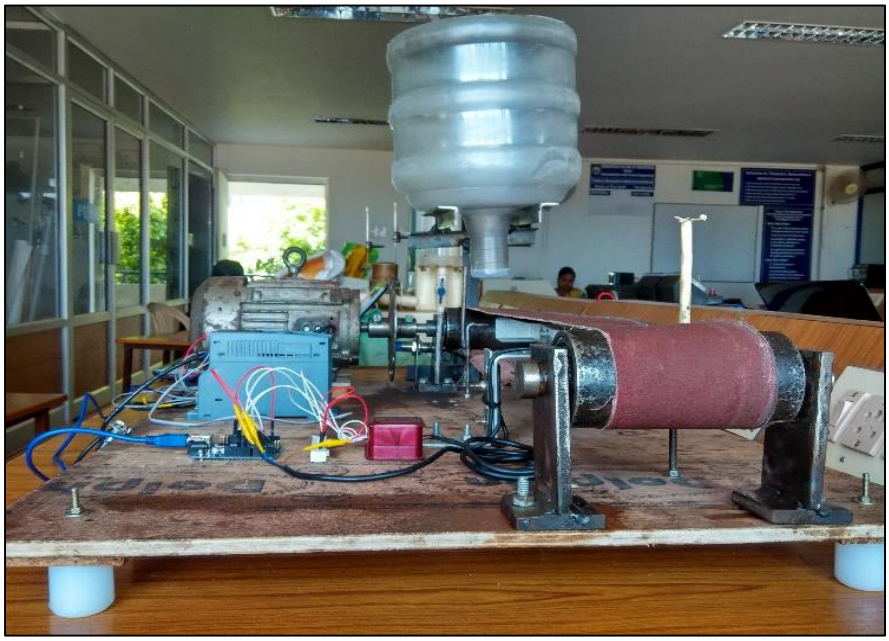
G. Outcome of Our Project

We had completed our project as of now was by controlling the speed of motor and loadcell measurement was taken. By checking with weights (gm) loadcell was calibrated. We had designed a labview graphical program which was interfaced with Arduino software , so we can able to view the weights moving in conveyor belt by graphically and graph can also be plotted between time vs speed of motor.

III. CONCLUSION

We had planned to extend our project to control the speed of motor by android mobile app development and fixing set point in mobile to fill a tank in specific period of time. As a result of we conclude that controlling the speed of motor is done by VFD drive and measuring the weight is done by loadcell.

A. Result of Project



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