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Design analysis of Filling and Weighing machine in Milk Powder Plant of Dairy Industry using Load Cells and Conveyor System

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Abstract - *Improvement automation in drying plant using workload senor. A workload balancing algorithm always tries to answer a particular problem. Among other things, the nature of the tasks, the algorithmic complexity, the hardware architecture on which the algorithms will run as well as required error tolerance, must be taken into account. Therefore, a compromise must be found to best meet application-specific requirements.*

Key Words: **Milk powder, Load cell, Conveyor, Weighing machine, Design analysis automation.**

1. INTRODUCTION

Presently, milk powder is collected in sacks of 25 kg. Here the sack is allowed to be filled through a powder filling machine and once the required amount is filled it is placed aside manually to weigh. According to the tolerance limit, the powder is added or removed from it according to its weight. After weighing, it is sealed and kept aside.

Following are the components used in our design.

1) Sensors
2) Load cell
3) Conveyors

1.1 Sensors

A sensor is an instrument, system, or machine whose function is to notice changes in its surroundings and send the information to other electronic devices and frequently used computer operations. A sensor mostly works with other electronics.

- Types of sensors are:
  1) Active sensor
  2) Passive senor

Active sensor:
The active sensor generates electric current/ voltage directly in the response to environmental conditions.
The active sensor does not require an external power source.

Active sensor example: solar cell, thermocouple, piezoelectric material.

Passive sensor:
The sensor produces a change in some passive electrical quantity in response to the applied measure band or stimulus. Such sensors are considered passive sensors.
The passive sensor does require an external ac or dc voltage source.

Passive senor example: strain gauge, photodiode, a thermistor.

Application of sensors in our aspects:
- very fast response time in rising and filling
- the potentiometric measuring with a precise quantity
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1.2 Sensors such as Load cell

Load cells have been used to gauging force as tension. they are very accurate and reliable sensors to measure a load. A load cell is made from elastic material (with a very highly repeatable deflection pattern) to which several strain gauges are attached.

The formula: function x time (to perform function) x frequency = basic workload. This is the simplest way to calculate the basic workload of most tasks at hand.

Working of load cell:

When the load is sensed by the body of a load cell, the elastic member creates a strain at those locations due to the stress applied. As result, two of the strain gauges are in compression and the other two are in tension.

During an evaluation, the weight acts on the load cell's metal spring compartment and causes elastic deformation. This strain who is positive or negative is converted into a digital signal by a strain gauge placed on the spring

element.

We use the Wheatstone bridge circuit to convert this change in strain/resistance into a voltage that is proportional to the load.

When filling the sack of the required amount of milk powder workload cell is essential. It measures the amount of powder fallen in a sack and when the required amount is acquired it holds the machine for some time to switch the sacks.

Prospective use of Load cell in our aspects:

- accurate filling of mass concerning net weight
- supplying efficient and economical load at the same batch.

1.3 Conveyors

A conveyor made up of a fixed location roller over which material can be given movement through thrust or gravity

-Types of conveyors are:

1) Roller conveyor.
2) Bucket conveyor.
3) Chain conveyor.
4) Screw conveyor.

Roller conveyor:

Roller conveyors are used for single or uni-directional material handling. Roller conveyors are designed in such a way that large and heavy loads are moved on them easily. roller conveyors are a form of conveyor belt that utilizes rollers (evenly spaced rotating cylinders) to allow objects to slide across its surface. They move material from one place to another desired location with the help of gravity or implement small motors for working.

Application of Roller convey in our aspects:

- Primarily in material handling applications such as baggage handling.
- Truck loading and unloading and packaging.
- Portable assembly line.

2. DESIGN OF AUTOMATION

Design of automation guides you to enable re-use of engineering ideas. Automation is not just for precise work. it is a new era of spending time on tedious manufacturing. Digital manufacturing is scaled as an upstream development process.

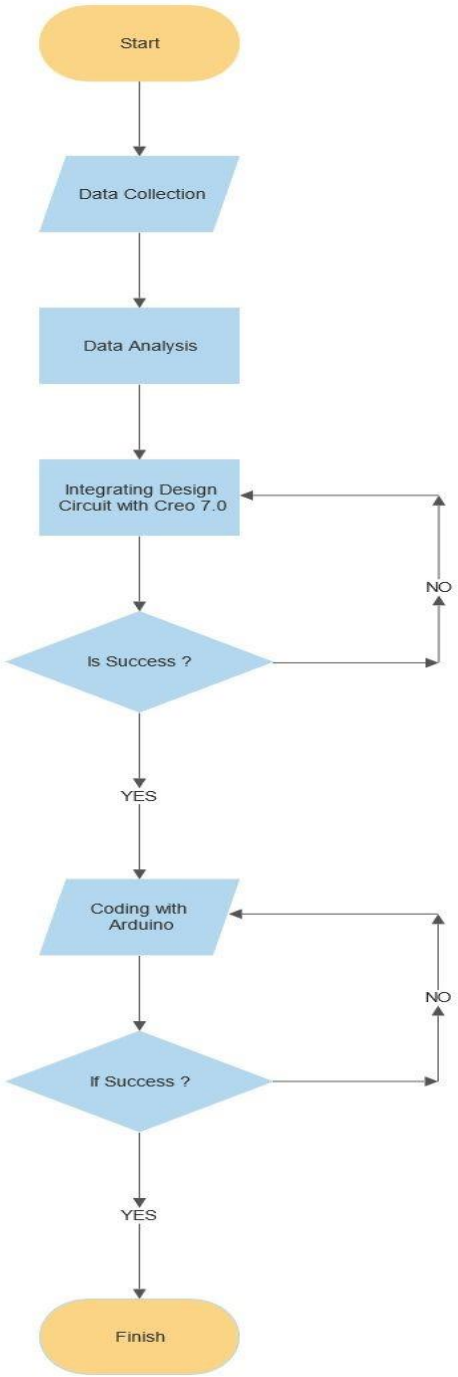

Chart -1: Flowchart of a journey towards the design of automation

The above graph mentions the process of design of the weighing filling device. The process starts with data collection and analysis of data which we collect then set a parameter that meets and satisfies our requirements. After that actual design begins with Creo parametric 7.0 if the design is successful it will be sent to a further process which is based on an intelligent system called Arduino.

Arduino is a chip that can run and control signals by programming. If programming goes success a final design move to final approval.

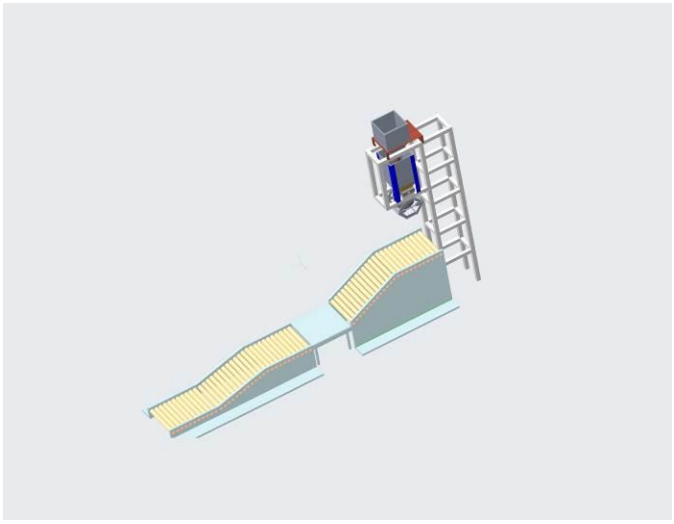

Fig -1: weighing filling machine with full assembly

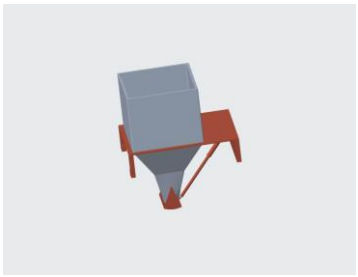

Fig -2: Reserve hopper

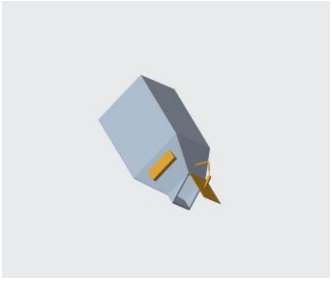

Fig -3: weighing hopper

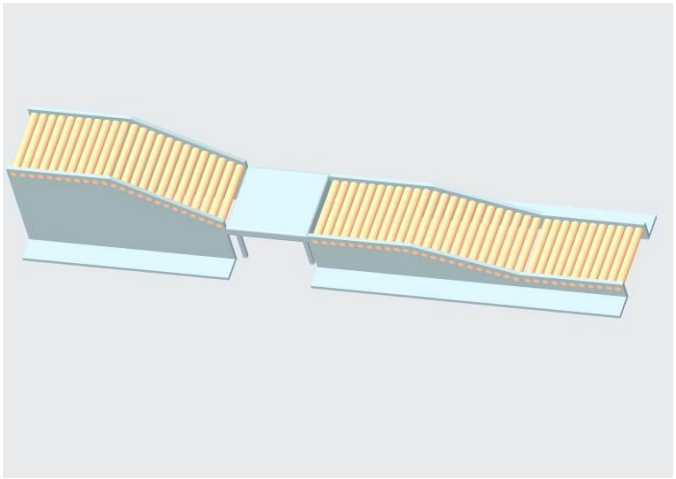

Fig -4: Conveyor

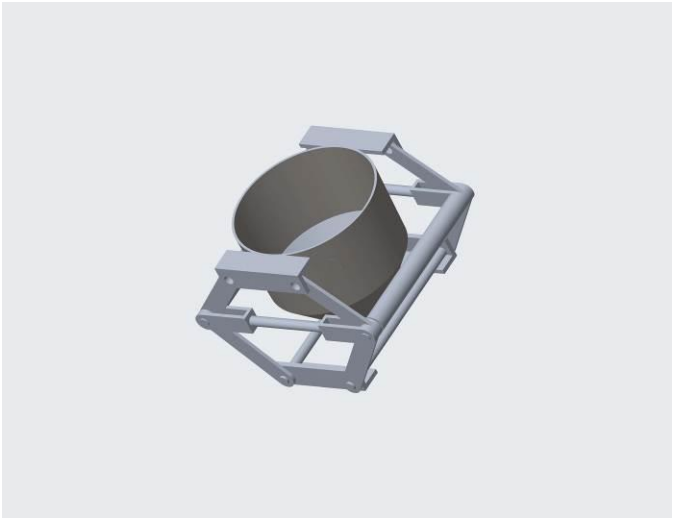

Fig -5: Bag clamp device

Design of powder filling machine, the main part of this model is reserve hopper, weighing hopper, bag clamp device, and conveyor.

The reserve hopper is just a vessel that contains milk powder with a feeding gate when a gate is open. powder falling to the weighing hopper.

The weighing hopper is important to part attached to the load cell (sensing element). A load cell senses the accurate weight and meets the requirements of a specific product. The weighing hopper is also fixed with a gate mechanism. The intelligent control system operates the gate with help of a load cell.

Once a signal control feeding close gate turn close the powder falling into the bag which clamped with bag clamp device furthermore, bag suspended off to roller conveyor and the device will release the bag then after the user does the bag's sealing process.

Machine's application:

- an automatic weighing filling machine use for particle items with good fluidity.

3. CONCLUSIONS

The intention behind this study is to reduce the lead time of production as well as to overcome manpower in a hazardous environment. Furthermore, it will give a ready sack at the desire location without any human intervention. It is pure automation technology that creates a better future for the industry.

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