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Standardisation and Secrecy of your Recipe For Global Market






White Paper - HVPL

Systemised Vibrations

Executive Summary

The manufacture of blended snacks, baked food, spices and similar food mixtures often involves the material transfer of several ingredients in varying proportions to mixing and extrusion processes. These ingredients are categorized as majors, minors or micros based on their proportion in the blend. In many cases, the transfer and weighing of these majors, minors, and micros is a tedious manual process. Manual methods compromise on the overall process efficiency when the production demand increases. Also, with human handling and intervention, the likelihood of inadvertent contamination of the processed food increases.

Another common concern in the processed food industry is protecting the secrecy of proprietary recipes. This is not possible when the weighing of constituent ingredients is left to human labor.

A partial solution to this problem is the use of Vibratory Feeders in conjunction with Load Cells for weighing the transferred material.

In this White Paper we describe an efficient and complete solution to the above using HVPL's Loss-In-Weight Feeder Controller System to simultaneously control the feed-rate and transferred weight of the ingredients while maintaining absolute recipe secrecy.

Introduction

Many recipes in the food processing industry involve mixing of various ingredients in unique proportions followed by other procedures like mixing, grinding, steaming or even packing. Traditionally these processes are carried out manually, where a person weighs or scoops out the ingredients in required quantities and then transfers them to the next process. This is a very labour intensive and tedious operation. As the production demand increases, this method starts becoming inefficient. Also, this method of weighing and transferring allows for a lot of human contact with the raw or intermediate materials. Hence the chance of contamination also increases, increasing the probability of negative impact on the product quality and brand value.

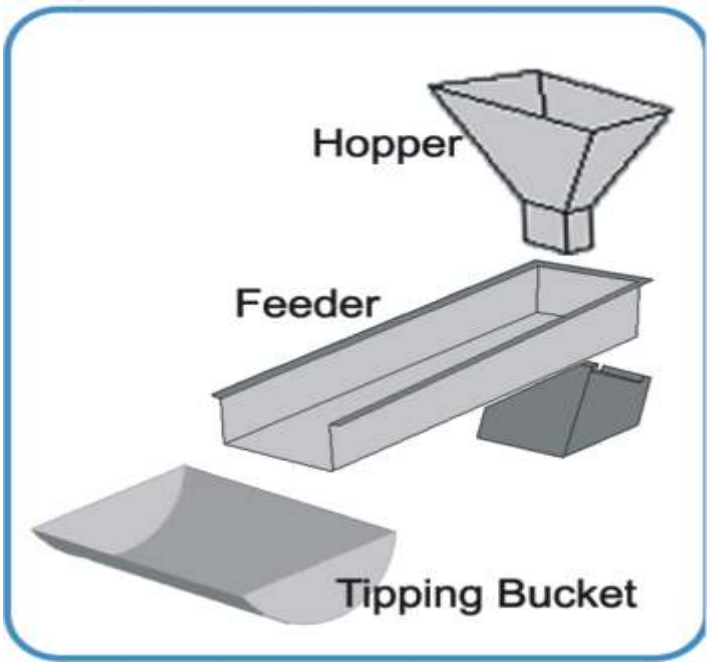
An even more growing concern these days is maintaining the secrecy of the recipes which constitute the intellectual property of a food processing unit. This valuable IP is lost in the traditional processing methods since the recipe needs to be shared with a several humans who then weigh and transfer the ingredients of the recipe.

Using a Vibratory Feeder in conjunction with a Load-cell to automate the weighing and transferring operation can solve both these problems. Conventionally, a post weighing system is used in such situations. A hopper and feeder system feeds the material filled in the hopper to a tipping bucket or similar arrangement. As soon as the weight of the material in the tipping bucket equals the desired weight, the feeding option is stopped and the material in the tipping bucket is dropped into another feeder for transfer or is dropped into the next stage of the process.

Conventional Solution- Post Weigh

An Illustration of the conventional Post Weigh Setup:

The load-cell is installed below the Tipping Bucket. Hence the desired weight of material falls into the tipping basket first. There are a few known lacunas with this implementation:



1. In case of material with finer particle sizes and having more adhesive strength (e.g. guar gum, icing sugar, xanthan gum, etc) a small amount of the material sticks to the bottom of the bucket and hence when the bucket is tipped, a quantity lesser than desired is delivered to the next stage.

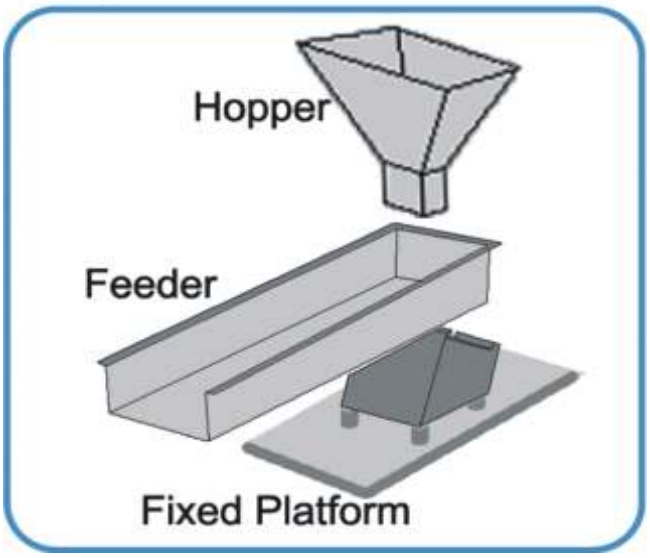
2. A more serious but less apparent problem is that of the time of flight. The feeder is operated at a finite non-zero feed rate during the process till the load-cell signals that the desired weight is reached. The feeder is stopped at this

point. In reality, a small quantity of the material has already left the edge of the feeder at the instant when the load-cell signals that the desired weight has been attained. This small quantity is the error in the total amount of material delivered by the system.

New Approach- Loss In Weight

The Loss-In-Weight System offers an excellent solution to both the above issues.

In a Loss-In-Weight arrangement, the feeder as well as the hopper is mounted on a rigid platform using resilient mounting. The load-cell is installed under this platform. Hence the weight of the entire setup is measured using the load-cell.



A Tipping Bucket or any similar arrangement is not required in this case.

The operator has to completely fill the hopper with the ingredient. The system recognizes the total weight of the setup & the ingredient as initial weight. While the feeding operation is in 4

progress, this initial weight goes on decreasing. When the decreased weight equals the desired weight, the feeding operation is stopped.



The material that leaves the feeder either falls onto the transfer feeder or directly into the next stage.

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1. In this scheme, some amount of structure borne noise is transferred onto the load-cell, thereby affecting the trueness and stability of the load-cell readings. In order to isolate the vibrations between the Vibratory Feeder and the fixed platform, resilient mountings are used. These mountings ideally do not allow the vibrations to reach the fixed platform. Yet, a very small effect of the feeder vibrations can be seen on the load-cell readings.

2. The complexity of the mechanical design of the entire system increases. Also, removal and servicing of the load-cell becomes tedious.

Electronics Involved

The most common approach when using a Load-cell in conjunction with a Vibratory Feeder is to use a PLC and a signal conditioner card to acquire the signal from the Load-cell and using an independent Vibratory Feeder Controller which communicates with the PLC.

This increases the system cost and also complicates the system integration. HVP's Unique Value Proposition HVP's Vibrodyne32 series DPAC-LC model of Vibratory Feed Controller offers the benefit of a Load-cell Signal Conditioner as well as an accurate Vibratory Feeder Controller in a single package.

The load-cell as well as the coil of the feeder are

connected to a single black-box and the user only has to select the amount of material to be fed.

This eliminates the need for a complex PLC based system and also reduces the overall cost of the system significantly.

The DPAC-LC can be used in both Loss-In-Weight as well as Post Weigh type of applications. 5 Very precise signal conditioning and adaptive filtration and curve fitting algorithms allow the DPAC-LC to perform very accurately in any setup. The Real Benefit of the DPAC-LC Based System The DPAC-LC



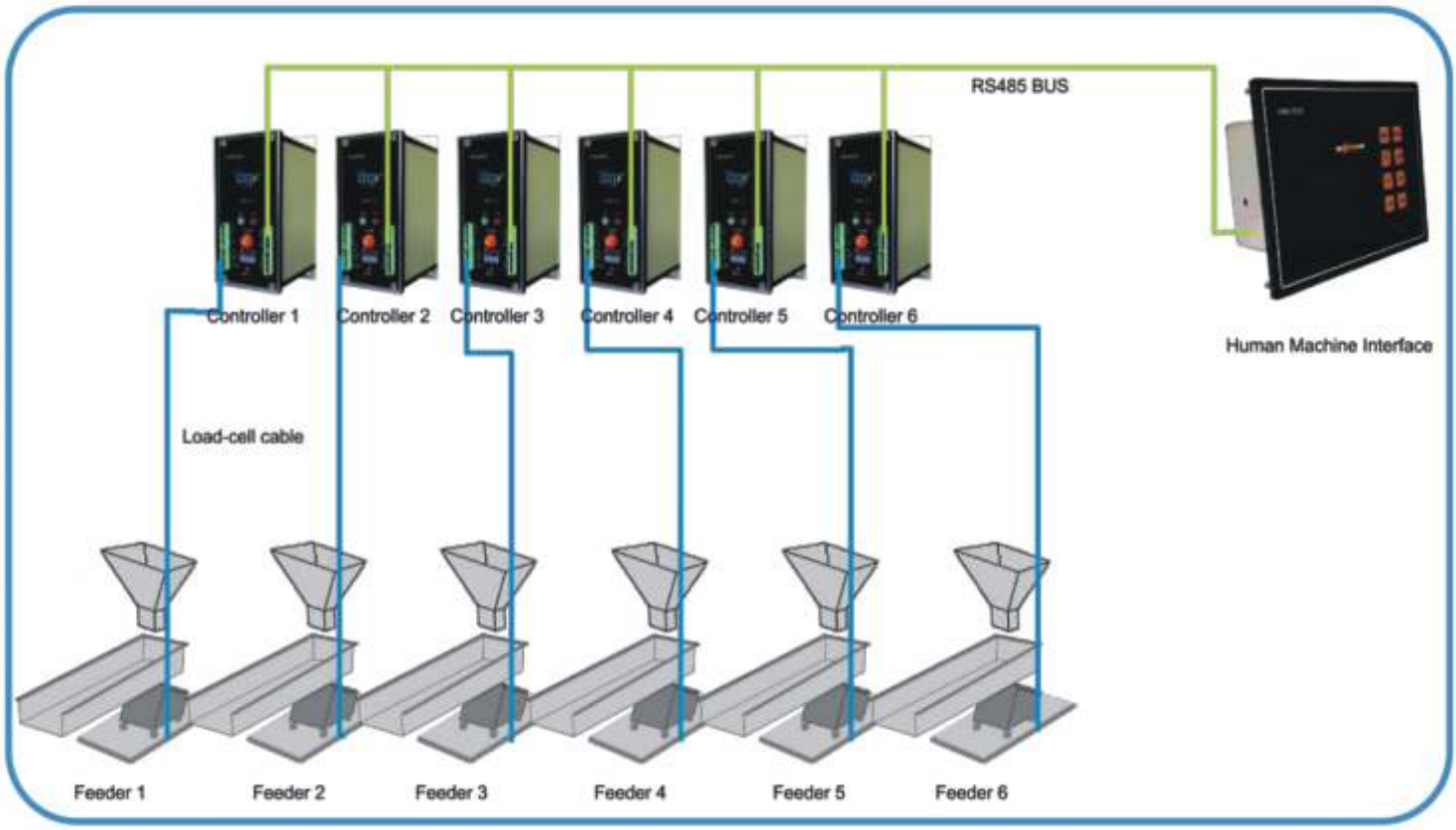
has an RS-485 port for communication. It can be hooked up to multiple DPAC-LCs and an HMI in order to implement a complete stand-alone batch processing system.

Each DPAC-LC controller has a set of switches on the front for RS485 address and mode selection. With the selected address, the user can communicate with the controller through the HMI. The HMI has a password protected interface. A user can read or alter the recipe proportions only after keying-in the correct password. Ten such recipes can be stored in the internal memory of the HMI.

When an operator has to start production for a particular recipe, all he has to do is select the recipe number on the HMI and issue the Start command by the press of a button.

The operator will not come to know the recipe quantities unless he has the password.

A hooter is sounded every time one batch is processed. The second batch can be started either through a digital input or an input over RS485 or through an HMI key-press action by the operator.



We will be looking at a few sample cases in the following pages.



Case 1: Cashew Cookie Making Process

Let us say a Cashew Cookie Manufacturer wants to automate his manufacturing process. The dry ingredients of his recipe per batch in the required quantities are as follows:

Majors:	Minors:	Micros:
20kgs Refined Flour	450gms Baking Powder	15gms Synthetic Food Colour
10kgs Brown Sugar 20kgs Icing Sugar	400gms Baking Soda	40gms Added Flavour
18kgs Chopped cashews	150gms Salt	

An efficient way of preparing for manufacturing the above batch of cookies will be to pre-mix the Minors and Micros in required quantities and add them directly to the mixer when the major ingredients are ready.

1. For pre-mixing the Minors and Micros, one needs five sets of Loss-In-Weight Feeders with a hopper capacity each between 1kg and 4kg with five DPAC-LC controllers. The Load-cells of the individual Feeder Systems will be connected to their respective controllers.
2. Let Feeder1 contain Baking Powder, Feeder2 Baking Soda, Feeder3 Salt, Feeder4 Food Colour, Feeder5 Added Flavour
3. All the controllers will be connected to a common RS485 bus along with an HMI. A PLC or other intelligent system associated with subsequent processes can also be connected on the same RS485 for better integration.
4. The Chef at the organization will have to enter his password into the HMI in order to access the Setup Screen. After entering the Setup Screen, he has to scroll through the connected feeders by entering the appropriate feeder number. For Feeder1, he will set the weight as 450gms, for Feeder2 400gms, for Feeder3 150gms, for Feeder4 15gms, for Feeder5 40gms.
5. Once these values are entered, he will save these settings as Recipe1. Similarly nine more independent recipes can be stored in the HMI.
6. All then the Operator has to do while starting production is, load the hoppers with the correct ingredients, select Recipe1 on the HMI menu and press Start.
7. Considering the desired weights of the ingredients in this example, it is likely that Feeder1 with Baking Powder will take the maximum amount of time to deliver 450gms. The other feeders will have stopped before Feeder1 stops operation.
8. Hence in this case, once the Load-cell under Feeder1 indicates that the weight of the system has reduced by 400gms and Feeder1 is stopped, a hooter will be sounded by the HMI and the subsequent conveyor or vibratory feeder or mixer will be started.
9. This completes pre-mixing of one batch Minors and Micros for manufacturing Cashew Cookies.
10. The second batch will be started upon a button press by the operator or upon receiving a digital start signal or start message over RS485.
11. A reasonable accuracy of 2gms can be maintained in the above example.



Case 2: Masala Milk Pre-mix Powder Making Process

A batch of masala milk powder manufacturing process might need the blending and subsequent grinding of the following ingredients:

Majors:
1.25kg Unprocessed Sugar
700gm Roasted Almonds
700gm Roasted Cashews
500gm Roasted Pistachios

Minors:
110gm Pepper Corns
110gm Nutmeg
180gm Cardamom Seeds

Micros:
75 gm Turmeric
50 gm Saffron

Blending the above ingredients in accurate quantities is necessary. Subsequently they will be ground to a powder form.

1. Considering all the ingredients, in this case we need 9 Loss-In-Weight Feeders with hopper capacities between 500gm (saffron) to 15kg (sugar).
2. Feeder1 will transfer Unprocessed Sugar, Feeder2 will transfer Roasted Almonds, Feeder3 Cashews, Feeder4 - Pistachios, Feeder5 Pepper Corns, Feeder6 Nutmeg, Feeder7 Cardamom, Feeder8 Turmeric & Feeder9 Saffron.
3. Once all the Controllers are connected to their respective Feeders, the Load-cell cables are connected to the Controllers and proper RS485 address is selected, the HMI can be connected and the system can be powered up.
4. The Chef will then have to enter his password into the HMI and access the Settings where he can specify the weights associated with each Feeder and store the same in one particular Recipe.
5. After the above one-time process is completed, the operator has to just select the correct Recipe using the Recipe Number, fill all the hoppers with the correct ingredients and press the start button to start the process.
6. All the 9 feeders can be mounted in such an arrangement that the material which falls from the feeders goes directly into the grinder/crusher.
7. Once the last feeder completes the feeding operation of the desired weight of ingredient, the HMI will understand that the batch has been completed. The mixer/grinder can then be started directly by the HMI through a digital output or through a command sent over RS485.

Similarly, this system can be used to improve the throughput, decrease chances of contamination and guard the recipes in a Food Processing Unit.

About HVPL - Hindustan Vibrotech Pvt. Ltd. is Product Design & Development organization, and aims at introducing affordable and reliable automation solutions for the food and pharma industry.

Along with the Vibrodyne32 series Vibratory Feeder Controllers, we also offer unique products like RF Dryer for Textile and Food, Spiral Impedance Dryer for low-cost, small-space yet efficient drying needs, energy monitoring and energy saving solutions, etc. We also offer remote monitoring, management and diagnostics of our controllers

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