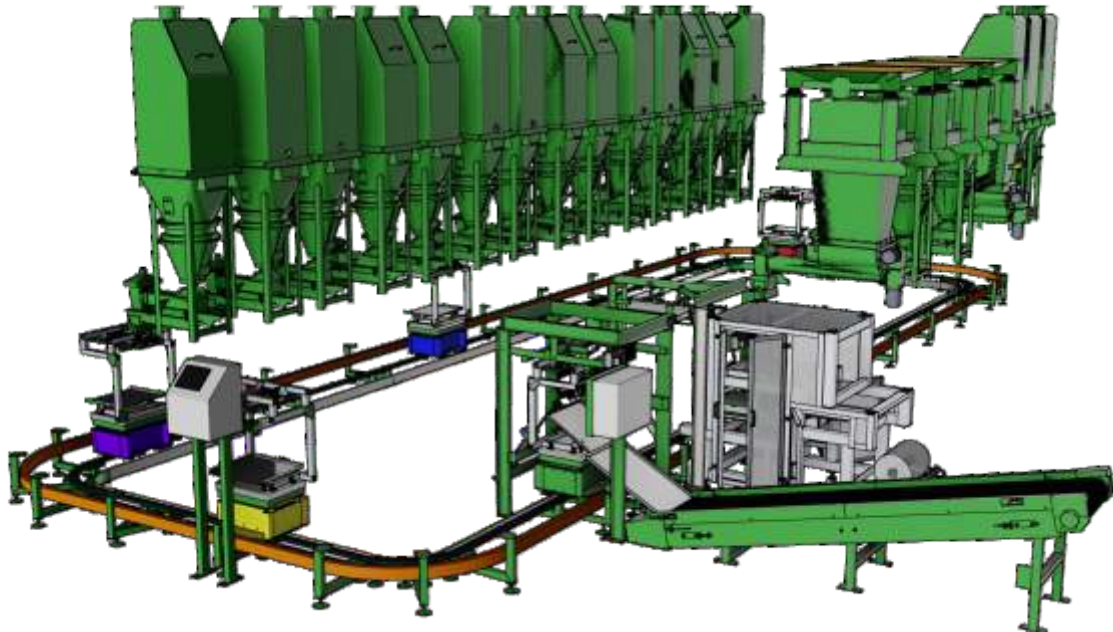


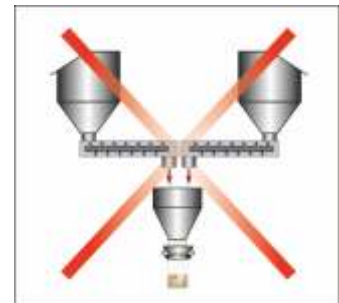
SMART CART

Fully Automated Minor Ingredients System



The Smart Cart History

The first generation **Smart Cart** system was initially developed over 15 years ago for a specific UK customer specialising in the custom compounding of Rubber. We were faced with overcoming a number of negative constraints typically associated with more traditional minor ingredients weighing systems. Such automated systems were generally based around a central weigher with integrated bag or bucket retention system and a number of feeders positioned around its perimeter. These type of system tend to suffer from: low accuracy, low throughput, material contamination and limited number of material feed stations due the physical restraints of a single central weigher.

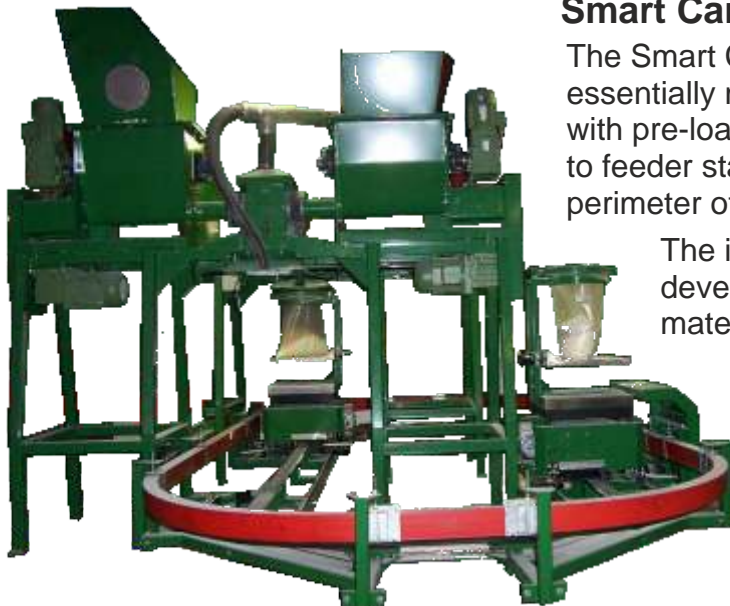


Smart Cart Philosophy

The Smart Cart overcomes these issues by essentially moving individual weigh carriages with pre-loaded receptacles (bags or buckets) to feeder stations situated around the perimeter of a monorail track.

The initial prototype system was developed with a limited number of material dosing stations and a manual

bag handling system to prove the mobile weighing concept. Bags are loaded onto the weigh carriage by hand before initiating the travel and weighing sequence via push button activation.



The Fully Automates Smart Cart System Development

Following the successful trials of the semi-automatic Smart Cart prototype the next phase was to develop a fully automated system incorporating an automated bag handling system for low melt bags including bag manufacture, placing, sealing and removal. This development stage also included the increase of feeder station numbers from 4 to over 30 together with the introduction of in-line bag printing and a fully automated control system including full PC based recipe handling and SCADA.



Material Storage & Dosing



Above the track system a mezzanine floor is installed to accommodate an array of material storage facilities each housing an individual ingredient. These comprise of both bulk bag discharge stations and sack tip stations, the split between the two types is generally dependant upon specific material usages. These stations discharge through the floor into surge / feed hoppers located above each dosing station. The associated dosing stations are either screw or vibratory feeders dependant upon the material type and incorporate radial discharge gates to improve accuracy and eliminate material over-run. When the weigh carriage arrives at its filling location below the dosing station the radial gate is opened and the dosing sequence commences. Once the target weight has been achieved the feeder stops and the gate is closed. The carriage then moves on to the next required dosing station in accordance with the recipe.

Bag Handling System

The bag manufacture system produces low melt bags from a roll of tubular material. Once the bag has been manufactured it is opened using vacuum suckers and automatically and automatically swung into position on the weigh carriage provided it is in position and ready to accept a new bag. When in position the carriage then clamps the bag in position and opens it ready to move on along the track to complete the filling process.



Material Weighing



The weigh carriages or Smart Carts incorporate high accuracy force motion platform scales to provide weighing accuracies of $\pm 3g$ or better. Bag retention is via an integrated bag clamp assembly which is activated / deactivated via on-carriage mechanical actuators. Multiple weigh carriages operate upon the same track system, each incorporating its own on-board PLC providing local independent control, weight signal conditioning and anti-collision system.



Control System

The main PLC is housed within a central automation panel which includes the master SCADA software and our KS-Series production control software, both operating upon a single PLC. The PLC provides automated control functionality for the material dosing system together with carriage positioning and bag handling systems. The production control system provided recipe handling and production scheduling. The recipe requirements are sent to the carriages via a wireless bluetooth link and carriage power is via a bus bar system running around the track perimeter.

