
AUTOMATED SUGAR BAG ACCOUNTING SYSTEM IN SUGAR MILLS

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ABSTRACT

Sugar mills play an essential role in India's agro-industrial framework, especially during peak harvesting and crushing seasons. Traditional manual methods of counting sugar bags introduce significant inefficiencies, including misreporting, delayed inventory updates, and potential losses. In this context, the paper proposes an Automated Sugar Bag Accounting System (ASBAS) designed to revolutionize sugar mill operations by implementing real-time monitoring and digital dashboards. This system uses programmable logic controllers (PLCs), web-based monitoring platforms, and centralized reporting frameworks to automate the counting and reporting of sugar bags across multiple mill locations. By replacing manual practices with automated and verifiable systems, this solution enhances accuracy, transparency, and accountability. The implementation plan, cost estimation, and expected outcomes are discussed in detail, making it a viable model for replication in similar agro-industrial sectors.

Keywords: Automation, PLC, Inventory Monitoring, Real-Time Dashboards, Sugar Mills, Data Reporting.

I. INTRODUCTION

In the context of rapid technological advancement and digital transformation, the need for automation in traditional industries like sugar manufacturing has become increasingly apparent. Across many sugar mills, sugar bagging and inventory tracking continue to rely on manual counting and handwritten logs. These processes are not only time-consuming but are also prone to human error, leading to discrepancies in stock reports, inefficiencies in dispatching, and misalignment in production figures. As sugar mills operate under seasonal time constraints and high production volumes, these inefficiencies can significantly affect the financial and operational stability of the entire supply chain.

The sugar mills in India have been grappling with these challenges for years.. A system that accurately counts, records, and reports these figures in real-time is essential for maintaining operational integrity. The Automated Sugar Bag Accounting System (ASBAS) addresses this gap by deploying real-time monitoring infrastructure, thereby eliminating the need for manual tracking and reducing errors in production reporting.

II. EXISTING SUGAR BAG MANAGEMENT MECHANISM

The current sugar bag management system is partially mechanized but remains heavily dependent on human oversight. Sugar from the drying silos is channelled into buckets which are subsequently emptied into bags using proximity sensors and gravity-based mechanisms. These bags are then stitched and sent via conveyor belts to storage godowns. Although weight-based controllers are used for bag filling, the final counting of bags is carried out manually. This manual tallying is the critical weakness in the entire process, leading to the possibility of miscounts and inaccurate daily production summaries.

The process flow typically includes filling the hopper with sugar, directing it via gate valves and flap gates, and routing it through magnetic filters into buckets. These buckets, when aligned with a stitched bag, release a predetermined amount of sugar. Once filled, bags are stitched and placed on conveyors which transport them to storage areas. Despite some automation, the final number of bags is tallied by godown staff at the end of each shift, which makes the system inefficient and error-prone. Moreover, there is no mechanism for real-time production reporting or centralized oversight.

III. OBJECTIVES OF THE PROPOSED SYSTEM

The primary objective of the Automated Sugar Bag Accounting System is to modernize and streamline the process of sugar bag tracking. This system ensures that each bag filled at the mill is automatically recorded in a central database. The goals of the proposed system include accurate and real-time counting of all sugar bags during the production process, seamless generation of shift-wise and daily production reports, and the establishment of centralized and mill-level dashboards for transparent monitoring.

Other objectives include enabling digital stock registers, integrating real-time inventory data with dispatch planning, and empowering management to make data-driven decisions based on live production data. The system also aims to reduce the manual workload of operators and improve the consistency and integrity of reported figures.

IV. SYSTEM OVERVIEW

The Automated Sugar Bag Accounting System consists of both hardware and software components. On the hardware side, the system uses programmable logic controllers (PLCs), sensors, Human Machine Interface (HMI) panels, and communication devices to record and transmit data. Each mill is equipped with a centralized PLC panel that integrates signals from multiple controllers installed at different bagging points. HMI displays installed on shop floors show real-time bag counts, categorized into large (L), medium (M), and small (S) sizes.

The software component includes a secure, web-based dashboard accessible at both the headquarters and individual mill levels. This dashboard is capable of displaying daily production counts, shift-wise reports, and cumulative bag counts. It allows for report downloads in PDF and Excel formats, which can be used for compliance and review purposes. The system is designed to operate continuously during mill shifts and transmits data in real time to the centralized data server. Integration with existing IT infrastructure is facilitated through LAN or Wi-Fi networks, ensuring seamless communication across locations.

V. DAILY REPORTING FRAMEWORK

The daily reporting framework is designed to align with the operational shifts observed in sugar mills. Production data is captured from 6:00 AM to the next day at 6:00 AM, divided into three shifts. For centralized monitoring, the SugarFed dashboard consolidates bag counts across all mills, while mill-specific dashboards provide granular details such as the number of L, M, and S bags produced per shift.

Reports are auto-generated and categorized into two main types: mill-wise summary and individual shift-wise details. Each report is structured to show the number of bags produced in each shift, allowing for quick review and cross-verification. These reports are available in both Excel and PDF formats and are stored in the cloud for long-term archiving and future audits.

VI. TECHNICAL SPECIFICATIONS

The hardware setup includes controller panels already installed across participating mills. Each panel is integrated with sensors that relay bagging data to a centralized PLC. A Human Machine Interface (HMI) panel provides real-time visualization of production figures. For backend communication, each mill is equipped with a PC that connects the PLC to the central server. To protect against environmental hazards, the PC is housed in a dust-free chamber. Internet connectivity is established via Wi-Fi or LAN to enable uninterrupted data transfer.

The software platform is web-based and built for scalability. It offers secure login credentials, data encryption, and role-based access for various stakeholders. Advanced analytics tools are embedded to allow performance comparisons across mills and over time. The software supports integration with existing ERP or MIS platforms, minimizing the need for infrastructure overhaul.

VII. BENEFITS OF THE PROPOSED SYSTEM

Implementing the Automated Sugar Bag Accounting System offers multiple benefits. The foremost is accuracy—the system virtually eliminates human counting errors. It also enhances accountability by offering real-time dashboards that allow immediate detection of production anomalies. With centralized control, higher management can oversee operations across multiple mills from a single location, streamlining decision-making processes.

Operational efficiency is also significantly improved, as automated systems reduce the burden on floor staff and minimize delays in report generation. Furthermore, the availability of real-time and historical data enables performance benchmarking, resource optimization, and timely maintenance interventions. The digitized inventory records also aid in compliance, reducing the risk of revenue leakage and discrepancies.

VIII. SCOPE OF WORK

The scope of work for the system's implementation includes both supplier and customer responsibilities. The supplier is tasked with delivering PLC-based controllers, complete with HMIs and integration-ready control panels. They must also supply all interconnecting cables and provide on-site supervision during installation. In addition, the supplier will be responsible for delivering a robust software solution that supports dashboard visualization and real-time monitoring.

The sugar mills, on the other hand, are responsible for ensuring the availability of power supply and stable internet connectivity. They must also procure PCs for data communication and allocate space for PLC panel installations. All post-installation maintenance, barring warranty claims, will be handled by trained mill staff following handover.

IX. IMPLEMENTATION PLAN

The rollout of the Automated Sugar Bag Accounting System is expected to be completed within 1 to 1.5 months. The plan includes pre-installation site surveys, equipment delivery, system configuration, testing, and final commissioning. Each phase is carefully timed to ensure minimal disruption to ongoing operations.

In addition to the technical setup, a comprehensive training program will be conducted for mill operators, IT staff, and management. The training will cover system usage, troubleshooting, and report interpretation. Post-deployment, a dedicated support team will be available for the first year to resolve issues and ensure smooth functioning.

X. COST ESTIMATION

Based on preliminary market research, the estimated cost of implementing the Automated Sugar Bag Accounting System in a single mill ranges from INR 9.82 lakh to INR 14.5 lakh. This cost includes hardware, software licensing, installation, training, and support services. Final pricing may vary based on site-specific requirements and customization needs.

XI. CONCLUSION

The Automated Sugar Bag Accounting System is a transformative step towards the digitalization and modernization of sugar mill operations. By integrating real-time automation and centralized monitoring, this system addresses long-standing issues of inefficiency and inaccuracy in sugar bag tracking. With its scalable design and high return on investment, the ASBAS model stands as a benchmark for similar applications in other agro-processing industries. The deployment of this system not only ensures improved operational efficiency but also lays the groundwork for a fully digitized and transparent sugar production ecosystem.

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