

Machine Information System for Bajaj Rotobar using PLC

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Abstract: Looking towards the importance of improved contamination-free of ginned cotton and a high degree of reliability and efficiency in the performance of machinery in ginning setup, rejuvenation, and automation in ginning is required. So, it becomes mandatory to continuously monitor the performance of the ginning machine. The main objective of the project is to monitor the performance of the machine and its troubleshooting with the help of the MIS system through PLC logic. The temperature control system plays a very important role in various fields like metallurgy, building materials, food, etc. By using this temperature control system, we can set temperatures as per our requirements. With the help of a PLC-based MIS system, we can create the time vs temperature Graph. Also, we can monitor the roll temperature hot spot with help of temperature sensor feedback. It will be very advantageous in calculating the performance of machines and accordingly do preventive maintenance which will lead to an increase in productivity.

Keywords: Single Roller Gin, Moisture Content, Pre Cleaner, Bale Press, Machine Information System, PLC, Temperature Detection, Lint Suction System, Conveyor System, Contamination Free System, Automation.

I. INTRODUCTION

Monitoring the Performance of the machine and its troubleshooting is done with the help of MIS (Management Information System) through PLC logic. A programmable logic controller is an industrial-grade computer used for the automation of machinery and processes in an industry by controlling inputs and outputs through programmable logic. The Application of the PLC-based MIS System covered in this Project is Rotobar Ginning Machine. It is the automatically PLC-operated machine for ginning of raw cotton. This machine separates the seeds & lint from raw cotton. The final output after gin is 50-70% seeds and 30-50% of lint. This machine is used for long-staple lengths of cotton. There is one roller that is used for ginning of Raw Cotton. this Roll gets hot while ginning .to monitor the temperature of this roll, a camera sensor is used to take the necessary feedback in PLC. Once the temperature of the Roll is sensed, the in and out action will be controlled with the help of PLC logic.

II. METHODOLOGY

Ginning is the mechanical process for separating cotton into its constituents, namely lint and cotton seed. In this project, we are focusing on the Rotobar Gins. It is the automatically PLC operated machine for ginning of raw cotton. There is one roller which is used for ginning. Rotobar Gins consist of three 3- phase Induction Motors of 25HP, 5HP and 1HP respectively. As shown in the Single Line Diagram the three motors are driven by three different VFDs (Variable Frequency Drive).For protection of motors 3P MPCBs (Motor Protection Circuit Breaker) are used of different ratings for three different motors. 45A MPCB is used for 25HP motor, 6-10 A MPCB for 5HP motor and 2A MPCB for 1HP motor. 63A MPCB is used for overall protection of circuit.. During the process of ginning (which separate the lint and seeds) the roller gets hot due to friction which can affect the productivity of machine. So, it is necessary to monitor the temperature of machine. To monitor the performance of machine we are developing a logic, which will create a graph of time Vs temperature. Also, the hotspot area of the roller will be detected. The graph will be

visible on the HMI (Human Machine Interface) Screen. With the help of this logic, it will be possible to monitor the temperature of the roller continuously.

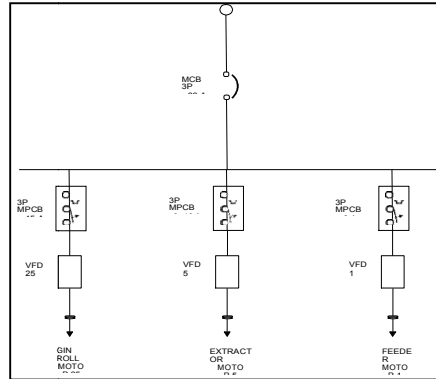


Figure 1: Single Line Diagram

2.1 Logic

1. @ temperature 50⁰ C roll start ginning;
2. @ temperature 70⁰ C roll stop and out.

With the help of this logic, we can monitor the following parameters-

- Temperature of roll continuously.
- Identification of hot spot area of roll to do preventive maintenance.
- Performance of machine in 24hours production.
- Display roll temperature trend on HMI screen.
- Display of graph of HMI screen and alarm.

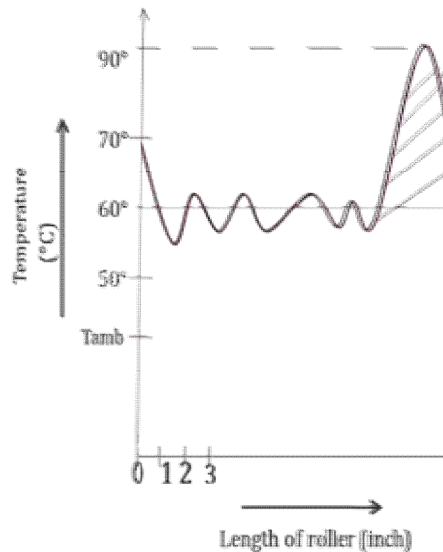


Figure 2: Temperature Vs Length of roller

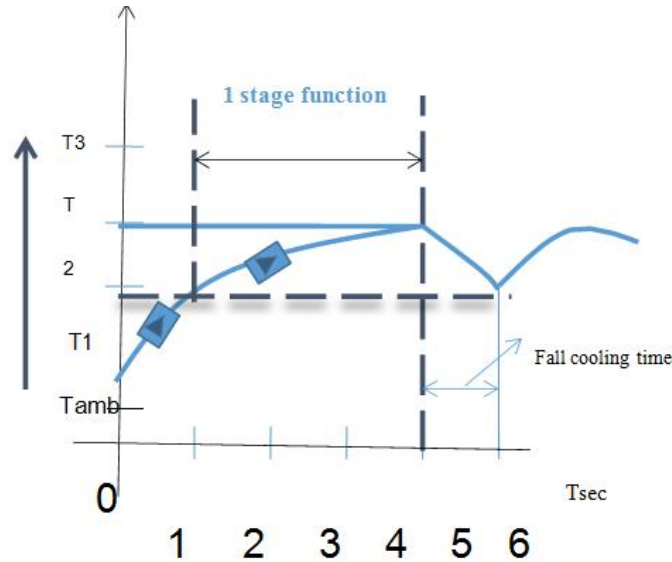


Figure 1(a): Machine 1 performance

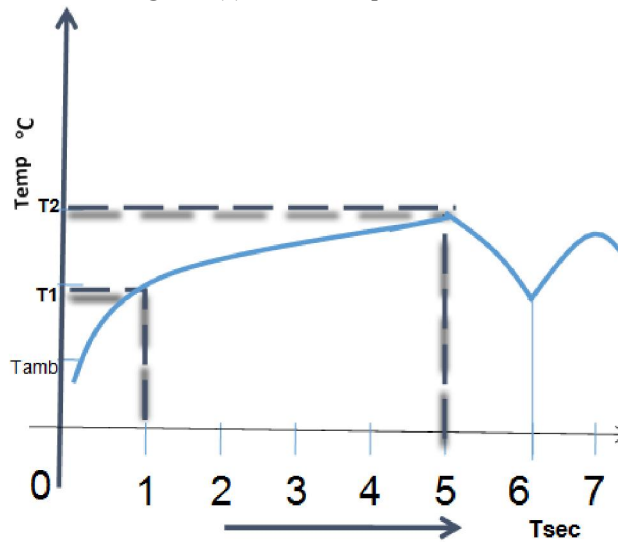


Figure 1(b): Machine 2 performance

III. ROTOBAR GINNING MACHINE

Uniform feeding of seed cotton to drying, cleaning, and ginning machines is very important to obtain proper efficiency of these machines. Through advanced conveyor systems along with advanced auto, regulators are mostly preferred for feeding the gin. Rotobar includes ginning roller and a stationary knife to which seed cotton is conveyed by the friction surface of the ginning roller for separating lint fibers from the cottonseed and a rotary stripping blade divide adjacent the stationary knife having blades forming a channel like pocket there between for receiving the cotton seed deposited on the surface. These seeds are advance over the edge of the stationary knife from the “pinch point” to “release point” and then releasing the seeds from the blade restrain at the release point before they are pushed beyond the length of the fibers attached at the “pinch point” to return to the knife-edge before the next blade applies advancing force to the seeds and withdraw substantially all the fibers from the seed. Hence rotoibar gins are usable for long and extra long-staple cotton.

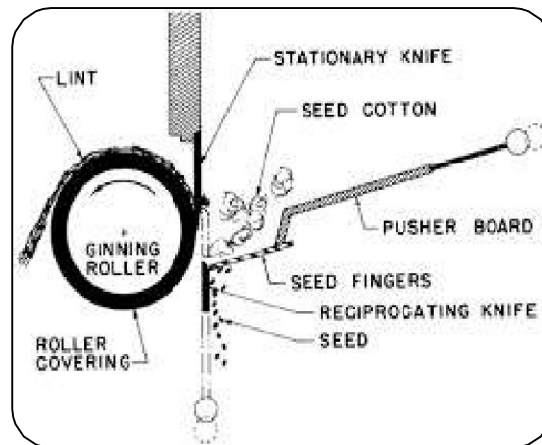


Figure 3: Process of Ginning

IV. PROGRAMMABLE LOGIC CONTROLLER

A programmable logic controller is a digital computer that has been used to control various manufacturing processes including assembly lines, robotic devices or any activity which requires ease of programming and process fault diagnosis. PLC's are of two type, compact devices with fixed number of inputs and outputs, and modular devices with multiple expansion of inputs and outputs.

In this project, we have used Mitsubishi MELSEC iQ-F Series Lineup FX5U. FX5U is provided with analog functions, communication, and high-speed I/O, and may simply be swollen with enlargement boards and adapters. The management scale is thirty-two points as well as CC- Link, AnyWire ASLINK, and teentsy series remote I/O. The Program memory is 128 k steps (Comments and statements in a separate area). The Built-in analog input/output are A/D 2 ch 12-bit and D/A 1 ch 12-bit. Where we are using analog inputs. The Built-in input/output function is 4 axes 200 kHz pulse output and Max. 8 ch 200 kHz high-speed pulse input. It is provided with a 16 GB Built-in SD Memory Card Slot to Stores device comment files and folders/files created by functions using an SD memory card. Built-in Ethernet Port control applications such as Socket communication (Direct connection to other PLCs) Remote maintenance (Read/write a program with GX Works3 connected via VPN) SLMP Communication (Read/write PLC device data from PC). The Built-in RS-485 port control application such as

- Inverter Communication (Max. length 50 m, max. 16 units can be connected)
- MODBUS® Communication (Up to 32 devices can be connected, including other PLCs, sensors, temperature controllers)

The software used for programming is PLC GX work 3.

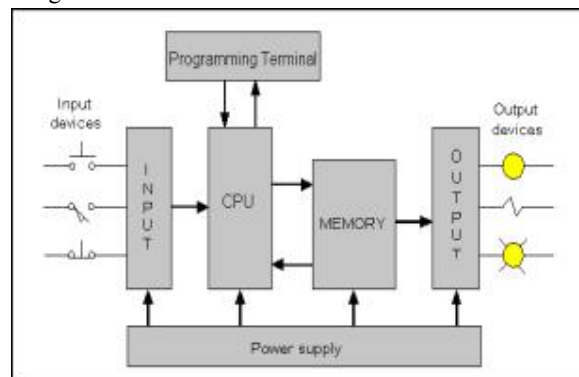


Figure 4: PLC Block Diagram

V. ADVANTAGES

With the help of a PLC-based MIS system, it is very easy to calculate automatically the performance of the machine and accordingly do preventive maintenance. Sensor-based individual gin feeding with auto regulators and advance conveyer will eliminate the complete requirement of manpower for feeding the gins and also ensure Continuous and controlled feeding as per the requirement of gin. With this system, it will help for higher production and reduction in manpower. The total power consumption for machinery is much lower in the fully automatic setup. Ease of troubleshooting. Increases the life span of the machine and its roll.

VI. CONCLUSION

The technology developments in the Ginning machinery have acted driving force and more productive advanced machinery. It has kept the momentum of modernization of cotton ginning in India. It is an automatically PLC-operated machine for ginning of raw cotton; therefore, the performance of the machine is very easy. This MIS application stores the data from PLC and generates the customized Reports and Graphs from the data captured. Hence various MIS graphs and data can be provided. This has helped to produce good quality cotton, increases the productivity of ginning machines, reduction of manpower and electrical power, reduction in contamination and improved cotton quality and fiber friendliness can be achieved, this are the benefits of these developments.

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