EFFICIENT AUTOMATION OF CONCRETE BATCHING PLANT USING PLC & SCADA

PROJECT REFERENCE NO: 38S0193

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INTRODUCTION
The advance in electronics and computer technology has resulted in enormous impact on various industrial manufacturing practices. One such application in cement industry is concrete mixing.

The traditional process used earlier for the concrete mixing, where workers used to carry the aggregate and mix manually. But sometimes the mixing proportions may not be up to the mark also it takes time to mix manually.

In the process of concrete mixing, an aggregate consists of gravel, sand and cement which are stored in a 4 bin arrangement, a weighing bucket will travel below this bin arrangements and collect the material from above bins. Each bin will have a motorized gate which will open and close the bin gate sequentially.

The purpose of this project is to automate the entire concrete batching operation and control, using PLC (Programmable Logic Controller) and SCADA (Supervisory Control and Data Acquisition) system, so that manual problems can be solved to a greater extent. In a fully automated system this operation can be completed within a few seconds which shows the time efficient and also the ingredients are weighed with help of load cell used and mixed in a given proportion automatically.

Objectives
This is a designed project for Industrial specification.
The objective of the project is to teach students the automation technology.
Here the students get exposure to

1. Automation Products:
   1. The students will get hands on experience on using PLC, SCADA, Proximity sensors, Load cell, DC drives etc.
   2. The students will also get exposure on the mechanical design of a weighing bin, Belt
Conveyors, Skip hoist or bucket elevator, winch system, screw conveyors, etc.

II. System Integration:

On the system integration side, the students will be learning the wiring practices used in the industry likes, Lugs, ferruling, terminals, etc. and also they will be developing the PLC program to make the above machinery work automatically without the need of any manpower. They also develop SCADA screen in the computer for this application. They develop mimic diagrams, report generation and logging function in the SCADA

Methodology

Methodology used will be as follows.

1) First step is to develop AutoCAD drawings for the mechanical manufacturing. The individual components and the assemble drawings to be developed. The components are weighing bins, travelling weigh hopper, motorized gates for opening and closing of the bins, the skip bucket, model of mixer, cement silo, cement screw conveyor, weigh hopper for cement, water and chemical additive. Mixer discharge door

2) Once the drawing is vetted by our machine builder/mechanical designer, implement the changes in to the drawing

3) fabricated the equipment, welding, grinding, powder coating etc

4) Integration of mechanical equipment with electrical system

5) Final trials and testing, demonstration, documentation

In this project, an automation scheme for the above process has been implemented using programmable logic controller (PLC) and Supervisory Control and Data Acquisition (SCADA) system. The PLC implementation has been carried out using Versa Max PLC, while the SCADA system has been implemented using Cimplicity software

Final assembly drawing(drawing-1)

Results

The SCADA screen in this project does a lot of things like MIMIC screens, alarm generations, logging
into the database and report generation. However in view of the vastness of the work, the scope of this project is limited to creating and executing MIMIC screens.

**SCADA SCREEN**

The above icon shows the aggregate weighing part of the batching plant. The operator can use UP/Down keys in each smaller display to set the desired weights of each ingredient. The larger display shows the value of each ingredient in a batch. The ladder program in the PLC separates in individual weights from the cumulative weights. The green lights lit up to indicate which bin is at present open, for the purpose of weighing. This is actually a maintenance tool. This helps the maintenance engineer to troubleshoot any wiring problem during running. The Icons shows the opening of the gate and falling of the material. This icons appears only if the gate in operation.

**CONCLUSION**

1. Fully automated plant of this type is very beneficial for society. If this were to be a manual plant there would be a need of at least 100 workers to carry out these concrete mixing for large mixing purpose. During the manual operation, the mixing may not be properly done and hence the quality of the product will be poor.
2. Automation not only speeds up the process by over 50% but also gives the same quality all the time and also increases the production by 60%. Automation needs only 2 to 3 operators and that too when there is a need. Otherwise everything is automated and runs on its own. Hence the total time required is substantially reduced.
3. In a fully automated system, one complete concrete mixing operation is done in every 25 seconds and no workers needed. In a large machine tons of mixing can be done in a day continuously.

**FUTURE SCOPE OF WORK**

The future scopes of work in this plant are,

1. The water weighing system can be incorporated by using load cells and hoppers which improves the quality of the concrete mix. Further there will be scope to add chemical called “Add mixture” which further enhances the quality of the mix by improving its strength.
2. NON contact measurement of moisture in the mixer using ultra sound technique can be adopted with the help of PLC and sensors. This helps in adding the appropriate amount of water irrespective of the weather condition and the wetness of the sand
3. Soft starters can be adopted for starting of the mixer instead of fluid coupling which is presently being used.
4. Periodic Report generating system can be incorporated, which gives information about the usage of materials .Additional limit switches can also be adopted for providing safety to the equipment for emergency conditions.