

Modernization of Wagon Tippler using PLC

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Abstract: -This paper proposed for modernization of electrical relay logic based wagon tippler by Programmable logic controller (PLC). By using PLC hardwired electrical relay logic is replaced by ladder logic. Relay based control system takes much time for fault finding. Hardware dependency is also a constraint. PLC facilitates for accurate break down analysis, very easy modification and monitoring of system. Nowadays nobody does logic with relays but everything is done in PLCs or similar 'computers'. And PLCs can also use analog values and implement very sophisticated logic.

Keyword: PLC, Wagon tippler, Relay logic

I. Introduction:

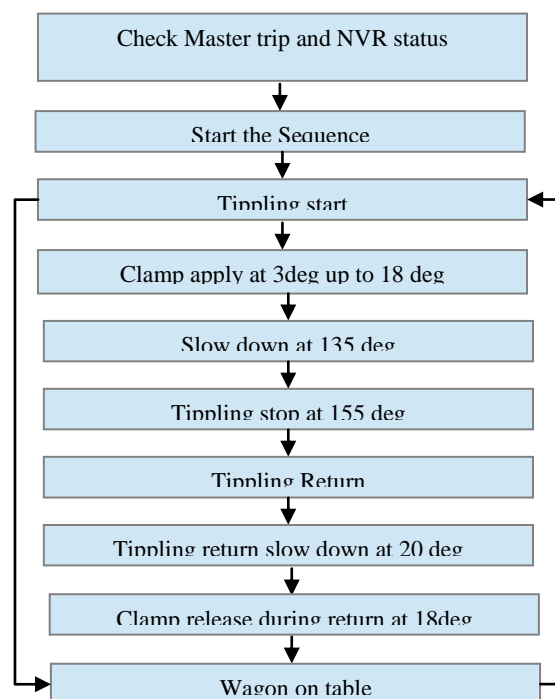
Wagon tipplers are used to discharge broad gauge open rail wagons. They have a rail table mounted on a rotary support structures which can lift and tilt wagons to an angle of about 155° at various processing plants such as power, steel, cement and for relocating the bulk material like iron-ore, lime-stone, coal, coke.

II. Proposed Methodology

Proposed method focuses on replacement of current control system with programmable logic controller (PLC) including suitable operation interface system. For implementation of said methodology all sequence control relay logic is replaced by equal ladder logic. Each signal relay (hardware) will be replaced by soft NO/NC contact.

In the existing system, each switch is connected to the input of a relay. When the switch closes or opens depending on the type of switch used, the relay energizes or de-energizes. The output of each relay can be used to energize another relay or can be used to enable certain outputs.

Fig. 1. Illustrates the process sequence of material unloading by wagon tippler, which shall be modernized using the programmable logic controller. This is a step by step process on which corresponds to the input and output peripherals that are needed in programming the ladder diagram. Included in the automation is the placement of wagon, clamping of wagon, tipping, wagon holding for material discharge, wagon return after discharge.



Present Status

Currently the system is controlled by hardwired relay logic system. Relay logic is a method of implementing [combinational logic](#) in electrical control circuits by using several electrical [relays](#) wired in a particular configuration. A relay is an electrically operated switch. Below figure shows actual relay-based hardware.



Relay are electro-mechanical switches that have coil and two types of contacts that is NO & NC. When NO contact is ON it will pass the current to the load, when NC contact is ON it will stop passing the current to the load. NO keeps the circuit open and NC keeps the circuit closed. If they are ON they do opposite job. When current passes through coil of relay it makes the contacts ON.

Currently operation is control by panel mounted push button, indication lamp, selector switch which is totally hardware dependend. every new requirement leads to complex wiring new hardware, panel cutout for fitment. panel mounted operator interface illustrated by below figure

Proposed Modification

Plcs born as a direct replacement for logic implemented using relays. At that time when we wanted to implement a logic we used to have a lot of interconnected relays in a way that they processed the inputs in a desired way to generate corresponding outputs. As a fact one of the language we use to program a PLC ([ladder](#)) resembles exactly the wiring schematics for relays wiring. A PLC system can manage directly their outputs but the current is normally limited to 2, 1 or less [Amperes](#). If we need more power, we can use an interposing relay that will receive PLC output as an input and it will have an output of more than 2 [Amperes](#).

Relay logic replaced by PLC based ladder logic, all sequence control logic, stop logic made as per operation requirement. Alarm, event and graph also define for better operation.

Programmable Logic Controller (PLC) and Relay Logic are and the way each offers a contribution for automation. Relay logic's referred to as relay since it uses relay for dominant control in the electronic circuits that happen several times in industrial applications. Besides, it additionally applies a contact in concert with management systems. To some extent, a PLC has its action for returning mechanical device relays logic whereas within the same time it additionally replace hold on program from antecedently solid state electronic computer. There is not much difference but just to get in more deeper:

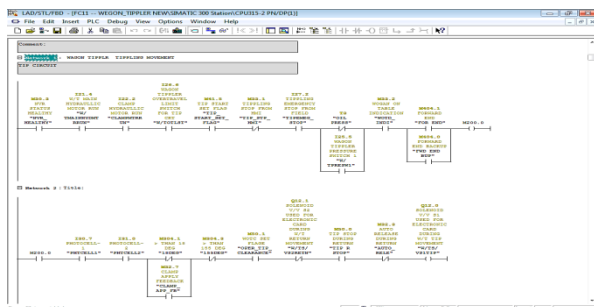


Fig-6(PLC ladder logic of wagon tippler tipping movement)

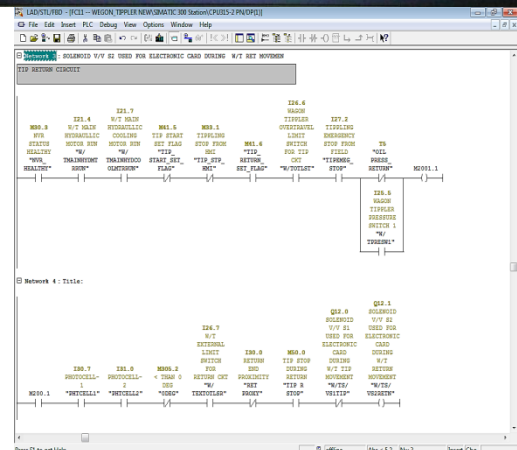


Fig-7(PLC ladder logic of wagon tippler return movement)

Plcs are one of the things more serious than a PC since it's typically used for industrial firms and supply input moreover as output. Once this program is running, the machine must scan the input whereas the output may be determined into relay logic. Moreover, it's circuit diagram that allows it to induce numerical language because the main purpose of this device, switch, timer, coil, and counter for convincing you everything's running well. Another distinction between a PLC and a relay logic in Relay logic, you'll study its circuits that has line diagrams and it ought to be connected to alter and manage a particular device. There are some applications in its relay logic, significantly for the routing and networks. These are things that can't be found within the PLC. Through these applications, relay logic plays its role for connecting the system for the sake of running the program well, as well as in the computer's electro mechanics

III. Results

By implementation of the improved PLC based control system following improvement will be expected:
Electrical Break down time shall be minimize by 50% because of fault identification will be very easy in PLC. System will locate fault which reduce time to resolve. Presently when fault occurred it is identify by point to point checking as per electrical drawing.
Timing of wagon tipping will possible in 100 second, presently it is 120 to 130 second.
PLC based system will provide deeper information of process by Alram, Trend, Event, report which are helpful for preventive maintenance and better process control.

IV. Conclusion

In this proposed system we will use PLC to automate the process and SCADA to monitor the process. The combination of PLC and SCADA provides an effective way to operate the wagon tippler. It overcomes many disadvantages in a relay based system and it increases the safety and efficiency of the wagon tippler by turning off the system incase of any abnormalities , Thus protecting the tippler and increasing the life .

