

Automation of Bucket Wheel Excavator Using PLC

V.Hemamalini¹, S.Hemalatha², M.J.Julie Dale Marine³, M.Mythili⁴, S.Naga Praveena⁵

Assistant Professor, Department of ECE, New Prince Shri Bhavani College of Engg. & Tech., Chennai, India ^{1&2}

Department of ECE, New Prince Shri Bhavani College of Engg. & Tech., Chennai, India ^{3,4&5}

ABSTRACT: In today's competitive world, for an industry to flourish it is very important that the overall efficiency of an industry should be high, for this to accomplish, the various control systems in process control should operate with high efficiency, speed and accuracy. So in such scenario, the system with which are operated in conventional methods like hard-wired relays have numerous drawbacks and limitations. To overcome the drawbacks that occur in relays, it is replaced by programmable logic controllers (PLC). A PLC is designed to perform the control operations logically by making the use of a program fed by the user. Due to this we can give various inputs to the PLC where the inputs can be changed according to the ladder logical program made by the user. The main aim of our project is to control the Bucket wheel Excavator in mining area. To control Boom1- Hoisting & Lowering, Total Structure - Slew Left & Right, Machine Movement - Forward & Reverse, Belt 1 & 2 - Start & Stop using With PLC.

KEYWORDS: High efficiency, speed, hardwired relays, ladder logic program, Bucket Wheel Excavator, Programming Logic Controller.

I. INTRODUCTION

In the recent years, - we use relays as control unit for bucket wheel excavator (BWE) in mining area. These relays increase the complexity in operation and also in analyzing the faults. Trouble shooting time is high in relays and also the wiring is complicated. Power consumption is more (30A). The voltage range is between 110V and 230V. Space required is more. Installation cost is more. Any logic has to be implemented mechanically. Because of the above disadvantages in relays we are replacing it with PLC.

In this paper more than 80% of physical wiring will be avoided using this intelligent hardware, whose operation purely depends on software. No limitation for the auxiliary contacts as in the case of hard-wired logic. We can use thousands of NO-NC for a programmed coil or register (solid memory). It does not require physical Timers, Counters. Power consumption is less. Accommodates very less space. Supports well for further expansion. User-friendly software – easy to understand. Maintenance is very easy.

The rest of the paper is arranged as follows. Section II related work. Section III system model. In section III scope of the paper. Simulation results are given in section IV. Section V summarizes the paper.

II. RELATED WORK

The reliability of the performance measurements and calculations of PLC systems by analysing automatically [1]. During the operation a system changes using various states continuously [2]. In this paper we take PLC technology for the operation of module in coal mine areas [3].

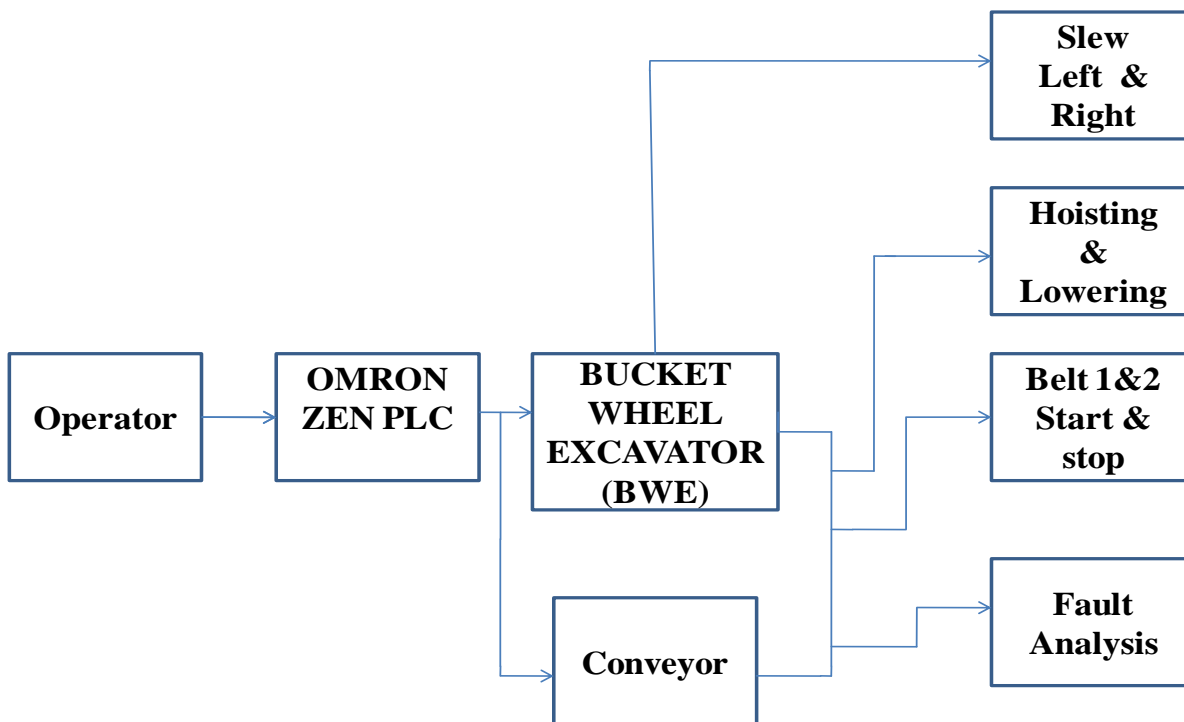
International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 3, March 2015

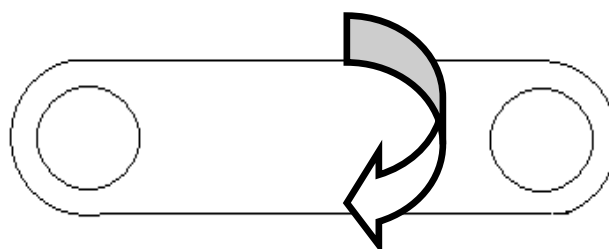
III. SYSTEM MODEL

fig .1. Block Diagram



It includes the Executive Engineers or the SME (Sequential Machine Equipment) Operator who operates the machine to remove the overburden by sequence of controlling the operations. A Programmable Logic Controller is a device that was invented to replace the necessary sequential relay circuits for bucket wheel excavator control. The PLC works by looking upon its state and depending upon their inputs. The inputs are given by the user using ladder logic. Our project, we are dealing the pull chord monitoring. We are considering two conveyors, namely 1 and 2 conveyors. Each conveyor has a pull chord switch. We have incorporated Programmable Logic Controller to monitor and detect the fault.

Conveyor 2



International Journal of Innovative Research in Science, Engineering and Technology

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Conveyor 1

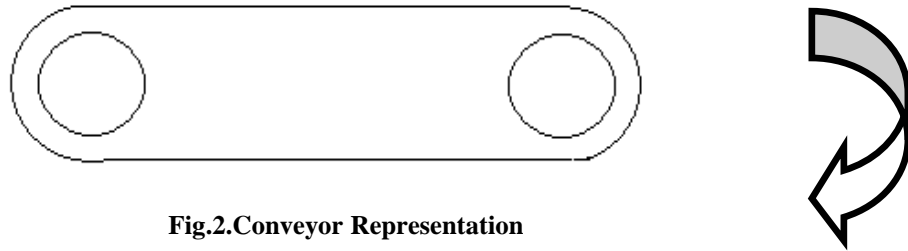


Fig.2.Conveyor Representation

The pull chord switch for conveyor 1 is named as pull chord switch 1. For conveyor 2, they are named as pull chord switch2. If conveyor 1 stops due to some fault, then conveyor 2 will also stop irrespective of its healthy running condition. But if there is some fault in conveyor 2, then conveyor 2 will only stop and conveyor 1's operation will not be affected. A chord runs parallel to the conveyors throughout the entire stream. On emergency the chord is pulled. It trips the motor to halt. It is similar to emergency chains in trains. The motor could be started only on resetting the pull chord switch. Generally pull chord switch is mounted on the walkway side of the conveyor belt. They are preferably located at about every 2 kilometres. When the rope is pulled, the switch is operated. This switch is used as a safety switch to stop the conveyor belt in case of an emergency.



Fig.3.Pull chord switch

BWEs are used for continuous overburden removal in surface mining. It uses its cutting wheels to strip a section of earth (the working block) dictated by the size of the excavator. Through hoisting, the working block can include area both above and below the level of the machine. The overburden is then delivered to the boom which discharge and transfers the cut earth to another machine for transfers to spreader.

III SCOPE OF THE PAPER

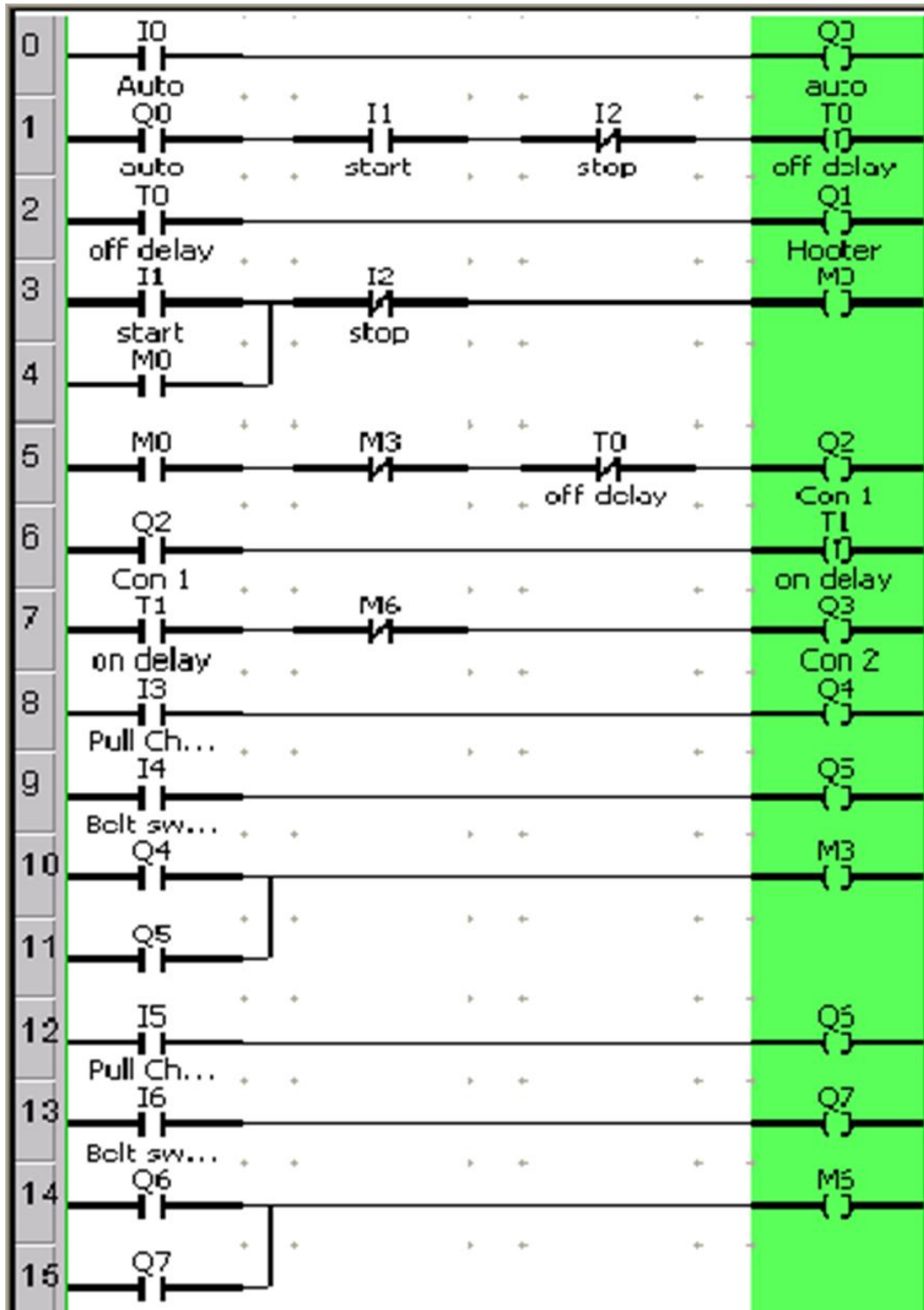
WORKING PRINCIPLE - BWEs are used for continuous overburden removal in surface mining applications. It consist of material handling system, collecting boom, discharge boom and counter balance boom, operator cabin, cutting boom hoist rope, crawler, undercarriage, bucket wheel boom. The program is fed to the PLC kit using ladder logic diagram. Work is to boom-holstering & lowering, slew -left &right, machine movement -forward and reverse and analyzing the faults. Working model is connected with PLC kit and the operation is controlled. If any Faults occurs it is displayed in PLC kit. When the fault is displayed machine will be stopped using pull chord. Time is reduced and production is increased.

International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 4, Issue 3, March 2015

IV. SIMULATION



International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 4, Issue 3, March 2015

In this ladder logic program the first input I0 is given with memory to switch on the alarm. The alarm is set for 3sec .After the 3sec the bucket wheel excavator is switched on after 4sec.At the 5th sec the conveyor belt gets ON. The input I1 is used as off switch. The switch I3 is used for slew left and I4 for right.

Then the whole machine movement is controlled by the input I5 and I6 for forward and reverse direction. The pull chord error is indicated using another switch. If the pull chord indication is ON the bucket wheel machine and conveyor switch will be in OFF state. Once the pull chord error is rectified the other switches will gets ON.



FIG.4 SIMULATION SNAPSHOT

V. CONCLUSION

PLCs are flexible in operation as the program can be changed within few seconds and leads to faster operation of Bucket wheel excavator system due to its quick response. Thus use of PLC, increases the speed of lignite transmission process. Consequently the production process speeds up and most importantly the consistency is achieved. By implementing PLC in conveyor control, monitoring and protection system, we can bypass any faulty part for required period of time, thereby reducing the break down time. This in turn leads to improvement in plant load factor and helps for improvement in generation of thermal power station.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 3, March 2015

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