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CONE CRUSHING INDUSTRIES ENHANCE PERFORMANCE USING CONTROLLING AND MONITORING

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Abstract: - jitavinash@gmail.com2,The selection of the best crusher from all of available crushers in market is a multi-criterion decision making(MCDM) problem. This problem overcome through applying analytical hierarchy process(AHP) methodology help us to criteria selection and logically and support to decision making. The crushing process is the first step to reduce size of particles from large size to small size. The selection of crusher through hierarchy process for the best result. As per this paper we can select best crusher according to available material as well as location. Almost approximately more than 3.5% total energy of world consumption in crushing industries. Energy consumption reduces through applying various methods like specific energy consumption(SEO), ratio control, cascade control, proportional integral derivation(PID), feed forward control etc. The system uses with high accuracy factor as well as proper planning of controller to low energy consumption and high production. In this paper proper execution of plant through proper selection of controller and logic develop as per test analysis report. So PLC and HMI use with other peripheral devices to execute result as per the process demand. The rack type PLC use and HMI use higher range model for remote accessing as well as plant data store more than 3 month. All field parameters properly getting and logic perform with proper process. Field parameter involve like pressure, temperature, level, speed, energy, ampere etc. These parameters monitor in HMI display with graphical representation. In present time production plants demand for more production, capacity, quality, safety, high accurate on-time reporting, low cost per ton ratio, properly timed maintenance, efficient management and reliable system controlling. Automation system provides reliable machine and process controls, performance optimization, networking, data collection and analyzing tools with remote monitoring capabilities all in one platform. This system is scale range from small standalone crusher controller to plant control and data acquisition system. For this system spares parts and repair to maintenance, training, operator cooperation, local availability support and improvement services as well as performance enhancements. This system capable to offer the most comprehensive, reliable, user friendly and productive solutions to the crushing and screening industry. In this system energy consumption reduces and system work on require power. These type of plant associate with automation components like programmable logic controller(PLC), Human machine interface(HMI), drive, transmitter, energy meter, sensors and other peripheral devices to controlling as well as monitoring of he plant. Finally I would like to say that using proper controlling devices to get appreciable result and reduces plant shutdown time.

KEYWORDS: *Controlling, Monitoring, Enhance, Energy, Cone crusher, Data acquisition, Automation.*

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I.INTRODUCTION

As per this paper basic introduction of cone crushing plant with advance control technique use to perform operation and quality work on other parameters. In figure 1 showing layout diagram of plant with individual components specifications. Some points which affect system performance of cone crusher plant[5].

1.Material properties : In cone crusher industries major objective is that reduces the stone particles size from large size into small size. Before crushing of material need to check all properties of stone like feeding size and shape as well as bonding properties. When material feed without proper knowledge of properties that time system work with unwanted condition like random shutdown, power failure and mechanical damages.

2.Dust environment : These type of plant completely surrounded by dust or sand particles. When large size stone size reduces that time approx 5% product convert into sand or dust. Therefor on every stages of crushing sand or dust particles creates problem in machine performance. The problem reduces through proper water spray at every stages of crushing due to this small particles settle down. Another problem generated due to water spray is that material wet and it creates problems in chamber of hopper.

The problem is generated by wet material is that the water molecules and dust molecules combine to auto create pasty material. The pasty material does not easily fall out from crushing chamber, therefore extra pressure in the chamber, unwanted liner wear and reduces performance of the system.

3.Control system : The control system also known as heart of crushing industries as per study. The crushing process is an important for these type of plant and these process proper execute when selection of controller as per the systematic like AHP. The main part of crushing industries is a control unit and all logical program develop in PLC system house. Therefore the selection process of control unit also play an important role for crusher performance.

4.Method of controlling : In today's life cycle a lot of methods available for plant control and monitor. In crushing industries use simple method as well as advance methods. Normally, these some method uses like feed forward, cascade control, PID, SEO, ratio control etc. When technology improve that time plant controlling methods also update by improvement in existing method or replace by new method. In present time advance control system implement in small as well as large industries due to this enhance system performance. In crusher industries PLC and HMI based system use to upgrade all type earlier system[2, 12].

5.Reduction Ratio: As per the system analysis reduction of stone size is the main objective of crushing industries. Jaw crusher have high reduction ratio compare to cone crusher but performance and accuracy wise cone crusher higher than jaw crusher. In cone crusher standard reduction ratio is 4:1 but when feeding size higher that time reduction ratio automatic increase due to system performance decrease.

6.Contamination: This section introduces contamination of the hydraulic oil and how impurities enter into the system. When study on these type of contamination that time problem solve and which type of hydraulic system use in future. These contamination are small particles and size range of 4-110 µm. A particle size of more than 40 µm visible by human eye. These type of contamination automatic introduces in system as per describes below.

a)Due to maintenance.

b)Assembly during installation.

c)Running or operating the crusher.

d)Components.

e)Water and dust particles.

Therefor, As per the study system will affect from many parameters and due to this decrease in plant efficiency, increase in energy consumption[8].

II.CRUSHING PLANT OVERVIEW

A cone crushers use in various stages of a sequential crushing process. Here in figure 1 showing plant schematic layout diagram and design part completed in DOP soft. In this schematic diagram showing various parts of plant[1].

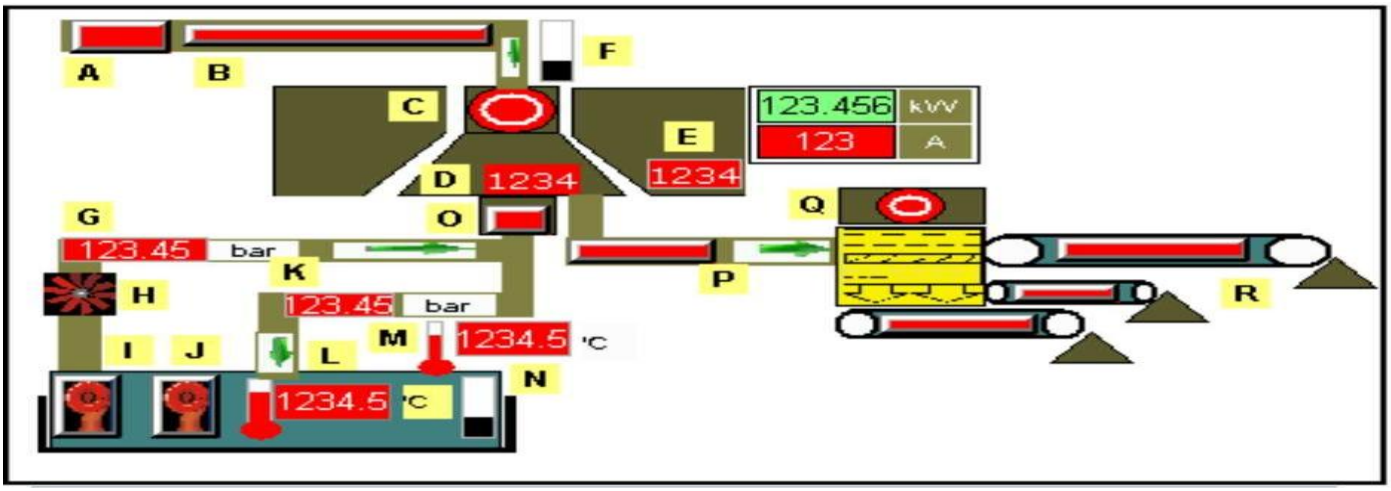

Figure -1 : Cone Crusher plant layout diagram in DOP Soft.

A.PAN vibro feeder : This unit install before cone crusher and feeding is control with speed control drive. The cavity level high in cone crusher chamber that time feeder control the speed of feeding material in close control loop or specific control method discuss earlier in abstract. The feeder work in On/Off mode as well as in PID mode as per the selection.

B.Feeder conveyor : The product material convey from feeder to cone crusher through this feeder conveyor. The metal detector sensor mount on this conveyor for protection point of view. When any type of metal detect that time signal generated from metal detector circuit and provide to PLC unit. The PLC immediately execute logic as per sensor feedback and machine halt or pause until not reset from operator side.

C.Main motor : The cone crusher main motor design as per process demand like 50kW, 75kW, 200kW etc. In my design 200kW main motor use and production capacity 200 TPH. The

main motor protect from all safety points and run feedback provide to PLC input terminal.

D.Limit value : This value defines the piston or main shaft position. This limit value change piston lifting or lowering. Limit value also use to protect system from up side touch.

E.CSS setting : In cone crusher one plate is movable and other one stationary. The CSS adjust as per setting in system parameters. The movable plate lifts toward stationary plate that mean CSS value decrease. As per the require product CSS value set by operator and in auto system actual value automatic adjust to nearby set value.

F.Hopper level(0-100%) : In the cone chamber hopper level sensing by analog sensor. As per this level sensor feed rate control through feeder as well as plant feed stop when level overshoot.

G.Lubrication pressure : The analog pressure transmitter use to fetch actual value in PLC and logic start as per logic develop.

H.Fan cooler : The hydraulic system design with fan cooler and this fan system use for temperature maintain. As per the system design set high and low value of temperature due to this fan cooler on/off as per upper and lower band.

I.Lubrication pump :The lubrication pump use to circulate lubrication in whole system.

J.Hydraulic motor : This motor operate when hydraulic system require in plant.

K.Hydraulic pressure : Hydraulic pressure measure through pressure transmitter and this is the most important factor of cone crusher. This pressure system also known as adjusting pressure. This pressure transmitter range from 0-100 bar and actual running range 0-35 bar.

L.Tank temperature : This temperature sensor permission to start the pump for minimum setting. A PT100 sensor use & directly connect to DTC1000 for temperature setting.

M.Return line temperature : The return line oil temperature sensor halt the feeding at 63 °C (146 °F) and the crusher at 65 C (149 °F). A cone crusher immediately stop if the oil return line temperature exceeds 68 °C (154 °F).

N.Oil level : In our system oil level manually check and fill as per require. In advance control system oil level sensor signal provide to controller input and monitor in display unit.

O.Puppet valve : This valve use at below the cone crusher and just nearby piston. The plant running that CSS maintain perfectly but several times unwanted condition occurs and pressure too high that time auto adjust CSS to decrease pressure. At this point gap increase and unwanted particle pass from chamber after that CSS auto adjust to actual setting value.

P.Screen conveyor : As per plant and product type many screen conveyor use to separate different size of products. In these conveyor one return line conveyor use to product again feed to feeder conveyor.

Q.Screen motor : The vibrating screen motor use to product discharge on screen conveyor. In the screen section different interlock type net uses for separation product and these product material handle to loading unit through conveyors.

R.Product conveyor : The final section of crushing unit is product unit. Finally product load at loading unit. The material handle from screen to loader through product conveyor.

As per observation and system design major components already discuss with their basic need and application. In plant overview also included raw material unit, transportation unit and loading unit[6, 13].

III.PROCESS FLOW AND CONTROL UNIT

In last unit describes basic components and their uses. In this process flow and control unit defines through block diagram. In every industry plant work as per process flow and all devices control through control unit.

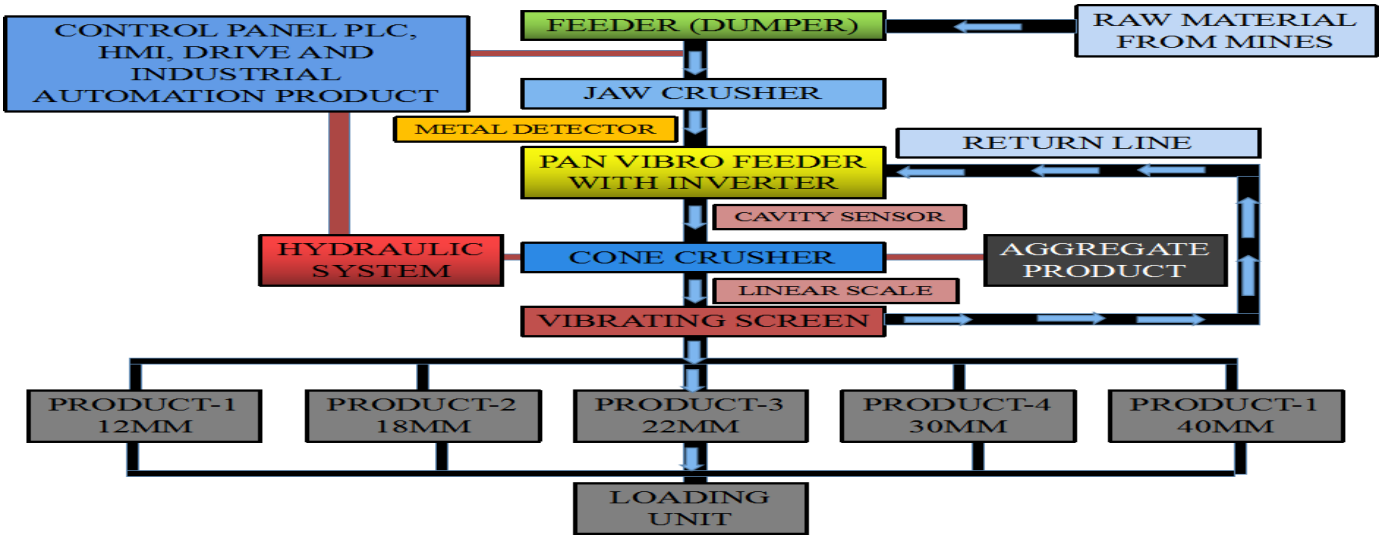

Figure - 2 : A block diagram of process flow and control unit.

As per analyzing of cone crusher plant some points enhance crusher capacity and performance.

roper selection of cone crushing chamber for material to be crush.

Proper distribution of particle size and accurate control feed rate..

Proper feed distribution around crushing chamber.

Discharge conveyor size design to carry maximum crusher capacity.

Advance automation controls with accurate feedback system[11].

Adequate crusher discharge area from cone chamber.

Some points which decrease crusher capacity and performance are describes in detail.

Sticky or less than product size feeding material to crusher chamber.

In crusher chamber not proper distribute material and feed rate not accurate.

Inefficient component capacities and not perfect material properties.

Operation of crusher not work on maximum require load[7, 9].

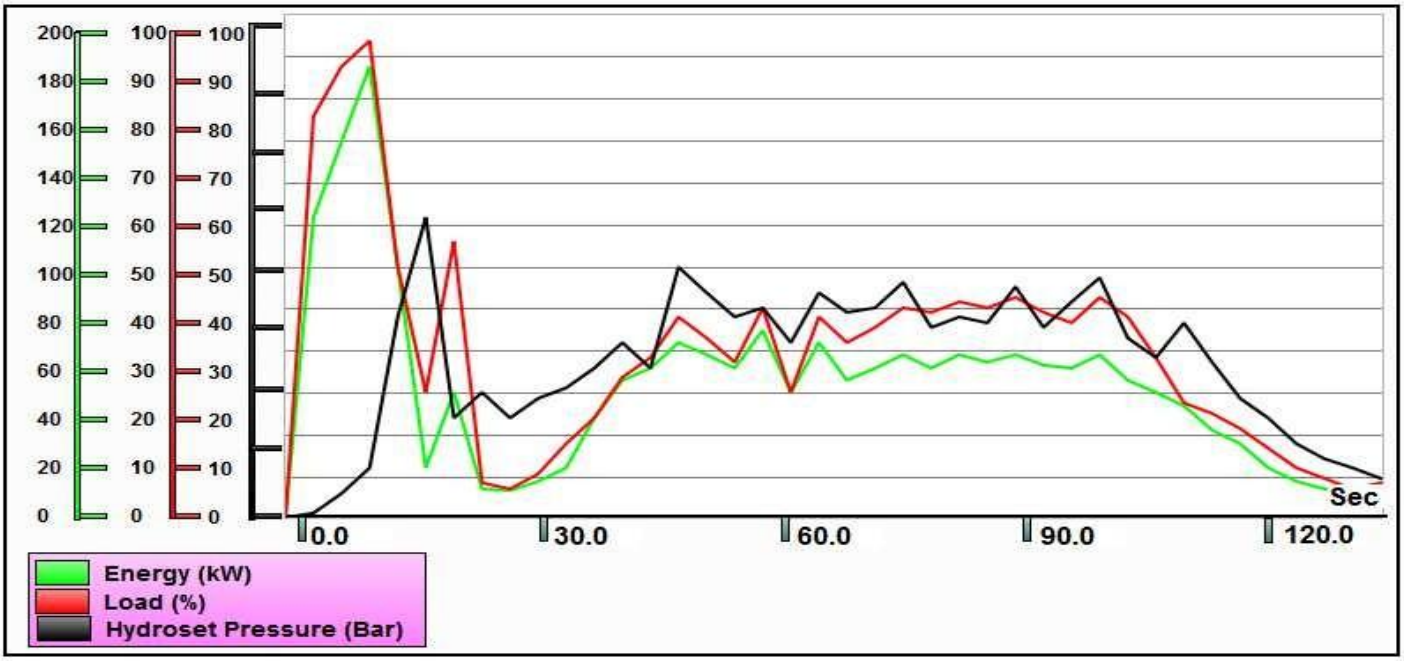

Figure - 3 : Graphical representation of energy, load and adjusting pressure.

In my observation the test result of energy, load and hydraulic adjusting pressure showing in figure 3 graphical representation. In this system start to normal run operation with steady state then stop operation showing. In starting of plant current is high so power consumption too high for some time. In starting time of process hydraulic adjustment disable for certain time limit. The load percentage ration gradually increase with increase power and ampere. In normal operation the hydraulic system adjust pressure to maintain CSS of production. The pressure increase or decrease as per the system requirements. The cone crusher show ideal condition that mean no load in chamber and power value standard approximately to 10-12kW[3, 4].

IV.SCOPE OF ANALYSIS

This paper analysis is an important part for understanding plant controlling as well as well maintain through advance technology. In this how to design and develop new invention and use in future application. This paper introduces advance automation and some common points for further improvements.

As per analytical view the selection of plant through these technique like AHP. The energy consumption factor study with load and without load. This study useful for industries and student.

V.CONCLUSION

This paper starting with introduction crushing industries then process flow with controlling, monitoring and end final product with analysis. In this paper discuss regarding the proper selection of plant as well as designing part and controlling unit. The programming logic develop in ISP soft and designing part in DOP Soft. Some standard protocols use for communication between these devices. All data store in HMI internal storage and analysis work on data for further improvement in system. The main objective of this paper to reduces system maintenance cost, mechanical damages, energy consumption, shutdown time and production, performance.

Finally I would like say that this system useful and user friendly for plant performance as well as production quality.

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