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A NOVEL APPROACH TO OPTIMIZE THE FAULT FINDING THROUGH PLC IN FACTORY AUTOMATION

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Abstract— According to this paper show some improvement of factory automation system problem by using programmable logic controller which is one of the best ways of solution in worldwide nowadays. This device is appropriate for superintend and examine industrial processes and may be applicable in multiple domains from factory automation industry and home automation control applications to industrial instruments, remote sensors and security devices. Many manufacture company using programmable logic controller rather than micro-controller because it has many advantages and also a multipurpose device. In this paper we will discuss some industrial problem optimized by automation system that means by Siemens plc version 5.5 S7300. And the issue is like, M.t.t.r(Mean time to repair), M.t.b.f(Mean time between failure), F.I.S(Factory information system) etc. Few years ago we worked with relays and coils that is the basic need of electrical. Since human intervention is more and errors become more but after some time with help of microcontroller and microprocessor we can also work with programmable logic controller with its own languages like ladder logic, standard structure etc. Here we are discussing Siemens plc and with the help of plc we can increased accuracy, perfection and efficiency.

Keywords— Process Automation, RFID tag and reader, Ladder logic diagram for Siemens S7 300 system

I. INTRODUCTION

In progression of technological advancement leads to development of controllers and respected various fields of engineering. The Siemens PLC is a robust industrial computer which accepts input data, both digital and analogue, from switches and sensors and controls outputs to drive devices such as motors, pneumatic devices and status indicators.Plc is the perfectly replacement of the elctro-magnetic relay with microprocessors and in the factory automation, in case if we utilize Siemens programmable control then we have to use digital computer which use for store the data and human machine interface with some controllers and sensors. PLC are the replacement of control relay logic and some essential micro controllers also; at its most advanced it can implement Proportional Integral and Derivative (PID) control algorithms over networks. The Factory automation would be one of the largest users of PLC.

II. RADIO FREQUENCY IDENTIFICATION DEVICE TECHNOLOGY:

All data has gone through RFID technology to the PLC and
It is consist two Part: (1) Tag (2) Reader.

With the help of electromagnetic fields to track the position of pellet which including various type of engine like diesel engine, petrol engine etc. Here this system resembles with bar code scanner system. Every engine has a unique code which connecting with plc as well as HMI of every stations and with help of them we can easily track the position of engine and sometimes with the help of various types of sensors.But sometimes there will be happen some issues like Duplicate serial number of engine pellet and that also overcome with help of programmable logic controller. An active reader passive tag system has an active reader. This transmits interrogator signals and also receives authentication replies from passive tags.There are two types of tag. Active tag as well as passive tag.System has passive reader which only receives radio signals from active tags battery operated transmit only.In the RFID technology include various type of frequencies available from 120 khz to 10 Ghz with respect to its speed. There are bulk reading strategy for interrogating multiple tags at the same time. Apart from this rfid has many applications like, access management, racking of good, toll collection and contact less payment, timing sporting events, tracking and billing proceeding.

Fig(1) A sample of RFID Tag and Reader.

III. DEFINATIONS:

- Cycle time: on deck present to in station release time.
- Down time: Here the meaning of down time is that, when pellet present on stopper for some operation it is take time called productive time and after the operation stopper become down from that action to next pellet present that time is called down time of machine.
- Loading time: on deck release to in station stop time.
- Unloading time: in station release to next stopper time.
- Run out active: to keep our pellet on the on deck station. When we pressed run out active mode.
- Manually bypass: if station for panther & upcoming engine is also panther but process is not much mandatory that time we press bypass on hmi & our bypass state active on.
- Auto bypass: if station for panther & our upcoming engine is dragon that time RFID automatically read & bypass the dragon engine its called auto bypass mode.
- Hold all reject: when all rejects then its hold for sometime but our cycle time remains continue.
- Hold & release: between running cycle if we pressed hold then cycle time will increasing but if cycling completed & accept the operation then it shows starved/blocked…but there no cycle time or load time or unload time increase.
- Dry cycle: cycle remains continue but cannot get any output/operation. Cycling without part operation.
- Pass through cycle: if machine previously rejected by some issue and that immediately it cannot reject or pull of spur by some issue that time it will reject by next station or it might be empty pellet then its called pass through cycle or if station for panther & engine is dragon that time also pass through cycle.
- Total unit: total cycle in productive time * parts per cycle.
- Good unit: : good cycle in productive time * parts per cycle.
- Reject unit: : bad/reject cycle in productive time * parts per cycle.
- Good (jph(job per hour)): $\frac{\text{good cycle * parts per cycle}}{\text{Productive time}/3600}$

Siemens S7 300 Plc (FAST) including:

- OB: organizational block(main routine)
- Ob1 is main block so to call in ob1 is mandatory directly or indirectly. ob35: cyclic interrupt, ob100:restart ob11: time interrupt
- FB: function block(sub routine) including programs
- DB: data block(sub routine) one type of memory & fc is diff. by each station.

IV. CALCULATED ON FOLLOWING FACTORS OF MTTR AND MTBF

Following factors:

1) Repair
2) Shutdown
3) Waiting attention
   a. Alarms
   b. Prompts
   c. Warnings
4) Tool change
5) Emergency stop

SURVEY OF FAULTS:

Faults On Which Work Was Carried Out : Undefined Machine Fault, Parts Hold And Reject Fault Pallet Travel Fault, Stopper Faults, Camera(GIGE), Scanner Faults, Rotary Fault E.T.C. , Pallet Travel Fault, Light Curtain Actuated,

Guard Door Open Fault, Robot Fault Gripper Not Closed, Guard Door Open Fault, On Desk Stop a Raise Stop Fault, Power Macs Nut Runner Fault.

V. IMPROVEMENT OF MTTR AND MTBF BY PLC:

First of all action taken by us for improvement of mttr and mtbf by plc is that,
Action oriented planning.
Taking backup from server & converting to csv file.
Surveying of machine and generating this faults.
Identifying top5 faults.
Data collection.
Analysis of faults.

Fig(2) HMI Represent faults.

- *Engine*:

All automatic stations with HMI screen have a PLC function to hold the engine at the station in case of a rejection. The engine can only be released by an operator. When a quality rejection or a machine fault occurs then this function is useful. It holds the engine at the station and stops the line so that the issue can be inspected by the qualified personal. However during normal production, it causes unnecessary stops. Especially in AUTOMATIC TEST STATIONS (Which perform tests on the engine to check its quality) which are expected to have more number of faults due to quality issue. In Automatic station or Semi-Automatic Stations, the 'Hold Engine' fault represents the engine is NOT OK to be assembled due to machine or operator fault. The project scope is to identify and propose actions associated to equipment and not the product. Part quality is not a subject of this project.

- *Pallet Orientation Error:*

Downtime is generated during the assembly because of pallet orientation over the conveyor. One major reason is the operator not setting the orientation of pallet as required. This error is useful as it prevents the station to continue to do it's subsequent process and hence prevents the engine to be damaged. However this error is still shown even though the orientation of the pallet is correct but the pallet rotating on its own due to the sudden stop. In this case generally operator resets the station & sometimes has to be rectified by opening the guard door and giving the pallet a manual rotation in case it was not correctly oriented or giving a small shake so that the sensor recognizes the pallet to be correctly oriented.

- GRAPHICAL REPRESENTATION OF MTTR AND MTBF:

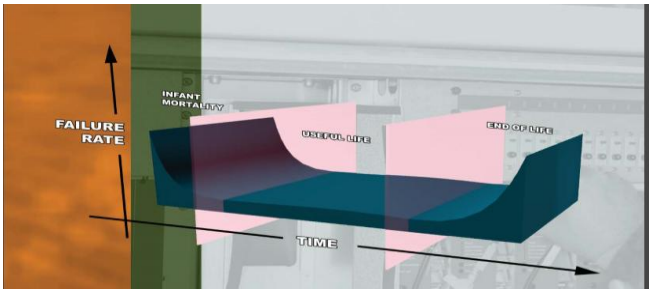

Figure (3) Graphical representation of MTTR &MTBF.

VI. INTRODUCTION OF FACTORY INFORMATION SYSTEM OF FACTORY AUTOMATION:

For monitoring machine states & to show in HMI and in VP Web application which is controllable by PLC through programming
FIS Included:

1. Plant floor network switch standard
2. Auto state diagram
3. Machine state details
4. Conditions to set states ON
5. Conditions to reset states OFF
6. Memory map details
7. Special inst. By equipment type
8. Special PID(part id) examples
9. Fault & warning file formats

VII. ANLYSIS :

EMERGENCY STOP

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HMI (Human Machine Interfacing)

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PLC(programmable logic controller) goes to FISSERVER(VP WEB)

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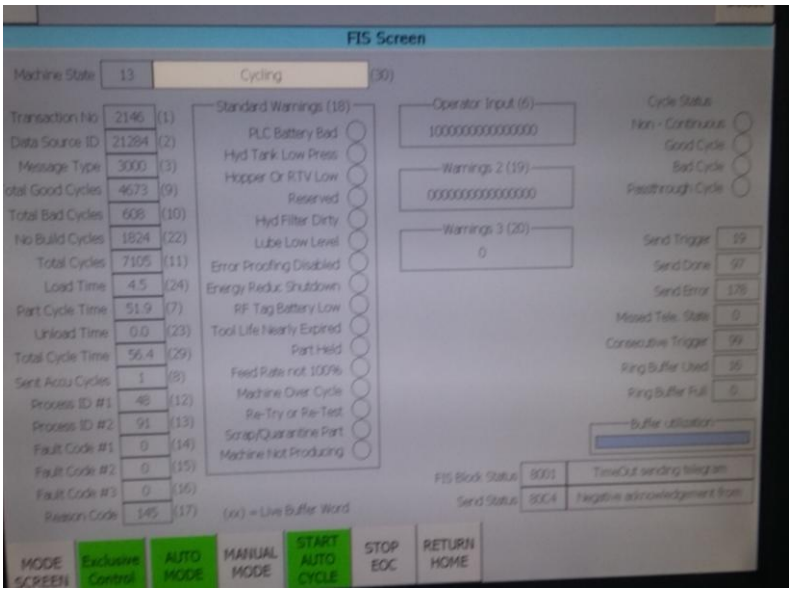
PROCESS STOP

VIII. MEMORY MAP DETAILS OF FIS SCREEN ON HUMAN MACHINE INTERFERENCE (HMI):

Transaction no
Data source id
Message type
Total good cycle
Total bad cycle
No build cycle



Fig(4) HMI Represent the details of memory map.

Total cycle
Load time
Part cycle time
Unload time
Total cycle time
Sent accumulator cycle
Process id#1
Process id#2
Fault code#1
Fault code#2
Fault code#3
Reason code

IX. NETWORKING:

FIS SEVICES

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MPN(main protocol network)

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CPN(control protocol network)

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Segment1 seg.2 seg.3 seg.4

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SCALANCE SWITCH

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Nut-runner,vfd, diff.drives,camera ,conveyor drives ,scanner

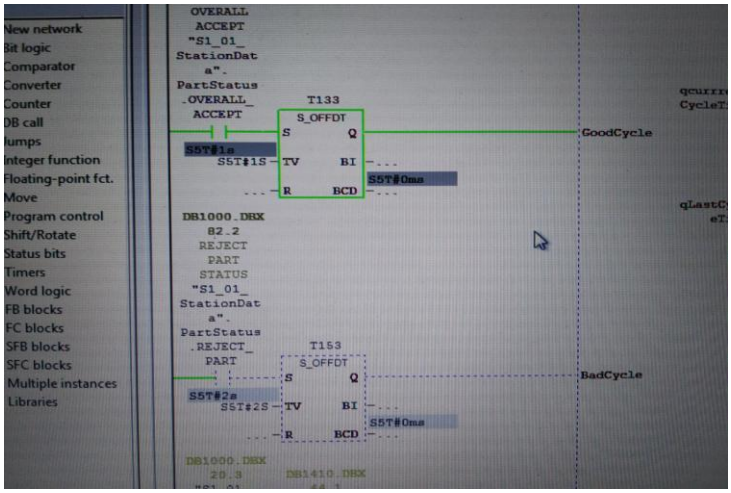
↓

PLC(hardware configuration)

X. IMPROVEMENT FIS DATA ACCURACY THROUGH PLC:

- Get back modify data into auto server
- Download in plc
- Initialization
- Compare blocks(offline/online)
- Backup from auto server

fis count indicates only total units and that time good & bad units are zero. That's why total units indicates some values. But the problem is that some station working for engine and fis count indicates all zero that means, total good, reject units are zero. So, that station have to solve by some procedure otherwise jph value becomes wrong & then mttr and mtbf report also indicates wrong. First of all to get backup from the auto-server because our offline programme & online programme might be different so, for safety purpose. Then create path and compare the blocks of DBs & FCs. Compare pin to pin configuration of FCs fis manager system of station and make one logic of high level sensor. Then next step is..INITIALIZATION procedure: first of all to open DB-1090 then go to edit option and do initialization and last download that db on to line. Initialization is one type of reset. Its initialize all data of station after compare the block of dbs. But one problem (rarely) is that due to initialization technique sometimes fis count shows garbage value like in thousands because of.. At downloading time fis data increasing suddenly at one time like 1 sec and that time plc take any value and fis indicates wrong data. To change time of good cycle from 2 sec to 1 sec shown in fig(5). because of data send and good cycle both simultaneously reset & set. That's why I have change time of timer. We have solve the problem of data send triggering by logic. To add new logic of in-station instead of on-deck stop logic and finally triggering the data send and fis indicates right data of station For particular time. All modify data are save in to auto-server backup so, in the future if we find any fault according to FIS count you must be follow that path.



Fig(5) Implemented PLC ladder logic

XI. CONCLUSION:

In this paper the concept of Programmable logic controllers and its applications are discussed. Above step which are providing proper way of solving faults like that and using their way we can save our process time for producing engine or any other product and sometimes IT department will get perfect data of system through FIS that is main advantage to increase accuracy of it.At the finally, an advancement of modular structure of controllers have increased and that is the increased reliability of plc configuration as well as graphic module, inter networking processing of data.One more thing there are various types of plc available in the market and nowadays they are constantly developing and using in wide range in numerical control technology as well as in Automation.

XII. REFERENCES:

[1] Rifkin, Jeremy (1995). *The End of Work: The Decline of the Global Labor Force and the Dawn of the Post-Market Era*. Putnam Publishing Group.
[2] Automation - Definitions from Dictionary.com". dictionary.reference.com. Archivedfrom the original on 29 April 2008.
[3] Hounshell, David A. (1984), *From the American System to Mass Production, 1800-1932 The Development of Manufacturing Technology in the United States*, Baltimore, Maryland: Johns Hopkins University Press
[4] *Bellman, Richard E. (8 December 2015). Adaptive Control Processes: A Guided Tour. Princeton University Press. ISBN 9781400874668.*
[5] *Bennett, S. (1979). A History of Control Engineering 1800–1930. London: Peter Peregrinus Ltd. pp. 47, 266. ISBN 978-0-86341-047-5.*
[6] S. Das, S. Dutta, A. Sarkar, S. Kar, "Recognition and Disposal of Faulty Bottles in a Bottle Filling Industry Using PLC and Producing Human Machine Interface by SCADA", International Refereed Journal of Engineering and Science (IRJES), pp. 18-23, ISSN 2319-183X, Volume 3, Issue 5, May 2014.
[7] K. Ali, R. Ghoni, A. N. Abdalla, "Advanced Control of Hybrid-PLC System", International conference on modelling optimization and computing, pp. 218-225, ISSN 1877-7058, June 2012.
[8] Groover, Mikell (2014). *Fundamentals of Modern Manufacturing: Materials, Processes, and Systems*.