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Classification of Instantaneous Stop For Machine Maintenance

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ABSTRACT: The purpose of the study is to improve the efficiency of automated part processing machines. In order to improve the efficiency of the machines, the instantaneous stop should be improved. An analytical methodology is developed for this purpose. The first step proposes a method of classifying the instantaneous stop for individual equipment in the automation system into three classifications as follows. The instant stop is divided into three categories: semi-chronic, chronic, and unexpected. The purpose of the division of the three parts is to facilitate the analysis of cause and to make progressive improvement. Procedures for improvement are as follows: semi-chronic type, chronic type, and unexpected type.

KEYWORDS: Classification, Instantaneous Stop, Machine Maintenance, Semi-Chronic Type, Chronic Type, and Unexpected Type

I.INTRODUCTION

Facility maintenance refers to activities that aim to improve productivity and quality through the life cycle of equipment and minimize maintenance costs. In order to maximize the efficiency of the equipment, the condition of the equipment should be precisely and accurately diagnosed. Also, reliability of equipment should be ensured by technical reasons such as repairing and determining the replacement time of parts.

Automated systems operated on manufacturing-based industrial fields are directly related to production and operational efficiency. Errors in automation systems not only significantly reduce production and operational efficiency, but also are related to the efficiency of operating costs. Errors in the automation system can be classified into failures and instantaneous shutdowns, and various studies are underway to analyze instantaneous shutdowns on the system scale to minimize operating costs.

The facility efficiency management items of the automation system operating at the manufacturing site are classified into predictable and unpredictable loss. The planned stop loss and the ready replacement loss are the main items of the predictable loss, and the failure and the pause are the main items of the unpredictable loss. The frequent occurrence of instantaneous stoppage in the automation line lowers the operation efficiency of the whole automation equipment.

In this research, to solve the problems caused by the instantaneous stop, the instant stop is classified into three types: semi-chronic, chronic, and unexpected type. This will help to facilitate the analysis of and cause of the failure and the cause.

By analysing the previous research through the theoretical review of facility management, facility maintenance, and six major loss and instant stoppage of TPM. The automation system identifies the factors that cause the instant stop and analyses instantaneous stop for individual equipment. In order to classify the three types of instantaneous stopping, accurate data will be obtained by subdividing the equipment, line, type, time and so on.

Manufacturing companies utilize manufacturing facilities to generate revenue for the purpose of enterprise. However, mechanical equipment wears and breaks as it is used and ages with the passage of time. These deterioration phenomena can be prolonged by the maintenance activities. Thus, facility maintenance starts with the design of the facility and minimizes the overall cost from installation, operation, repair and disposal to enable the facility to operate most economically.

Facility maintenance refers to all activities that minimize the cost of operation and maintenance of facilities and the cost of loss due to deterioration and improve productivity and quality by maintaining the best condition of facilities. Methods of facility maintenance describes in Table 1.

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Table 1. Method of Facility Maintenance

Classification	Contents
Planned Maintenance	It is a maintenance method in which maintenance activities are carried out in accordance with prior plans by dividing the facilities for preventive maintenance and the facilities for post-maintenance according to the importance of all facilities to corporate management.
Preventive Maintenance	It includes scheduled maintenance activities as a periodic check to detect any failure or stoppage of equipment, deterioration of performance, or loss of safety.
Predictive Maintenance	It is also called as Condition Based Maintenance because it monitors the operation status of facilities and detects the faults following the faults and takes necessary measures for the results. For this method, it is necessary to identify the physical phenomenon of the failure of each function or component of the facility, and to use a measuring device capable of monitoring this in real time. Experimental methods such as friction analysis, vibration analysis, thermal image analysis and lubrication analysis are applied. Such experimental equipment and methods are used as a very reasonable conservation method in terms of efficiency and economic efficiency due to the remarkable development of information technology.
Corrective Maintenance	It is a conservation activity that improves equipment performance to improve reliability, integrity, safety, operability, and economy of facilities.
Post-Maintenance	It is a conservation activity that restores after a breakdown because there is a lot of preventive maintenance cost than the maintenance activity to recover from an unexpected breakdown or recovery cost after a breakdown. ① BM (Breakdown Maintenance) It is an activity to set up complementary measures with time to spare due to an abnormal symptom of equipment, not an unexpected situation. ② EM (Emergency Maintenance) This is an action to take after a precautionary action about an accident that requires urgency in the event of a sudden failure.
Daily Check	It is a daily check by "Check Sheet" to identify basic measures for cleaning and cleaning facilities before and after work, and to detect and deal with deterioration such as abrasion, corrosion, and damage of facilities.

II. CLASSIFICATION OF INSTANTANEOUS STOP

The most important things for instantaneous stop zeroing are as follows. The first step is to subdivide the instantaneous stop. Second, it can classify the desired contents about line, equipment, error, type, and time, and identify the cause and countermeasures, and 70% of the problems can be solved only by the floor.

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1. Instantaneous stop segmentation

Subdivide instantaneous stops to create engineering models with semi-chronic (E1), chronic (E2), and unexpected (E3). For the purpose of subdivision, it is possible to speed up the phenomenon and cause analysis, and the efficiency of work is good as it is improved from knowing the cause.

2. Phenomenon segmentation

Table 2 is a phenomenon analysis sheet and it is a method to quickly and quickly solve the instant stop by subdividing by date, facility, function, error, type, and time to obtain accurate data.

Table 2. Phenomenon Analysis Sheet

Date	EQP ID	Alarm ID	Alarm Text	Alarm Count	Alarm Type	Time
01-01	TAPCN180	19202049	Plate-Fine-AA retry-over	1	E1	0.39
01-01	TAPCN180	20581120	Measurement of a mark position went wrong	1	E1	0.024
01-01	TAPCN180	21630976	Measurement of a mark position went wrong.(Right View)	4	E2	14.987
01-01	TAPCN180	35651686	DR COMPENSATION LIMIT OVER	1	E1	0.388
01-01	TAPCN180	35651687	MY COMPENSATION LIMIT OVER	16	E3	0.05
01-02	TAPCN180	35651684	MY COMPENSATION LIMIT OVER	7	E3	0.463
01-02	TAPCN180	35651686	MY COMPENSATION LIMIT OVER	3	E2	0.951

III. EXPERIMENTAL APPLICATION

1. Analyze Improvement Activity Data

Table 3 shows the case data of the improvement activities for the instantaneous stop of company D, and Table 4 shows the cases of improvement activities for instantaneous stop of company L.In the case of Company D, the data were aggregated and analyzed by counting the number of instant pauses, without subdividing the number of occurrences according to function and site by facility, and an example for comparison with L Company.

Table 3. Phenomenon Analysis Sheet Case of Instantaneous Stop Activity of Company D
(Number of instantaneous stopping incidents per facility)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
September	3,960	10,069	9,049	14,938	7,269	12,533	7,368	8,835	10,293	13,572	8,950	6,455	10,344	11,027
November	3,842	4,057	2,764	6,050	2,739	5,480	2,398	3,464	3,765	4,591	5,313	4,402	6,099	4,008
No. Increased	118	6,012	6,285	8,888	5,530	7,053	4,970	5,371	6,528	8,891	3,637	2,053	4,245	7,019
Increased Rate	3	60	69	59	76	56	67	61	63	66	41	32	41	64

The process data extracted from the facility is used as the basic data of the program. Process data should be integrity, since it represents the phenomenon of the spot and the spot. When these process data are concentrated and processed to create and utilize the value information, knowledge becomes wise and wisdom is created, and smart work becomes possible. What is not smart is to do unnecessary paperwork each time for information, and what is very serious is to do unnecessary paperwork even though computerized.

The instantaneous stop analysis system processes the process data for the instantaneous stoppage occurring in the facilities of the automation line and presents the target setting and improvement direction through MTBE and graph. And, it is aimed to maintain the maintenance by providing the information that can be analyzed through the monitoring, that is, the improvement.

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Table 4. Case of Instantaneous Stop of L Company

Facility	Function	02/17	02/18	02/19	02/20	02/21	02/22	02/23	02/24
G6 CAP	BF	3	5	13	17	11	7	2	3
	LF	4	2	0	0	1	0	5	3
	VAC	3	0	0	0	2	1	7	4
G6 SUB	BF	1	1	0	3	1	3	3	3
	LF	7	0	0	0	0	0	2	6
	VAC	5	0	1	0	0	2	3	1
G5 SUB	BF	1	1	0	0	2	1	2	0
	LF	2	2	0	0	1	0	1	2
	VAC	1	1	0	0	2	0	2	7

2. Instant Stop Analysis Graph

It is a method to quickly and solve the instant stop by subdividing by date, facility, function, error, type, and time to obtain accurate data. As shown in Table 5, the type of instantaneous stop is automatically determined according to the reference value set by the unexpected type, the chronic type, and the semi-chronic type by the facility and the function part. In the graph, a dividing line is displayed to visually confirm.

Table 5. Auto Classified Data of Instantaneous Stop

Date	EQP ID	Alarm ID	Alarm Text	Alarm Count	Alarm Type
01-01	TAPCN 480	976	Measurement of a mark position went wrong.(Right View)	1	Semi-chronic
01-03	TAPCN 480	048	Plate-Pre-AA retry-over	31	Unexpected
01-03	TAPCN 480	049	Plate-Pre-AA retry-over	2	Semi-chronic

Figure 1 and Figure 2 show the whole equipment graph collected manually and automatically.

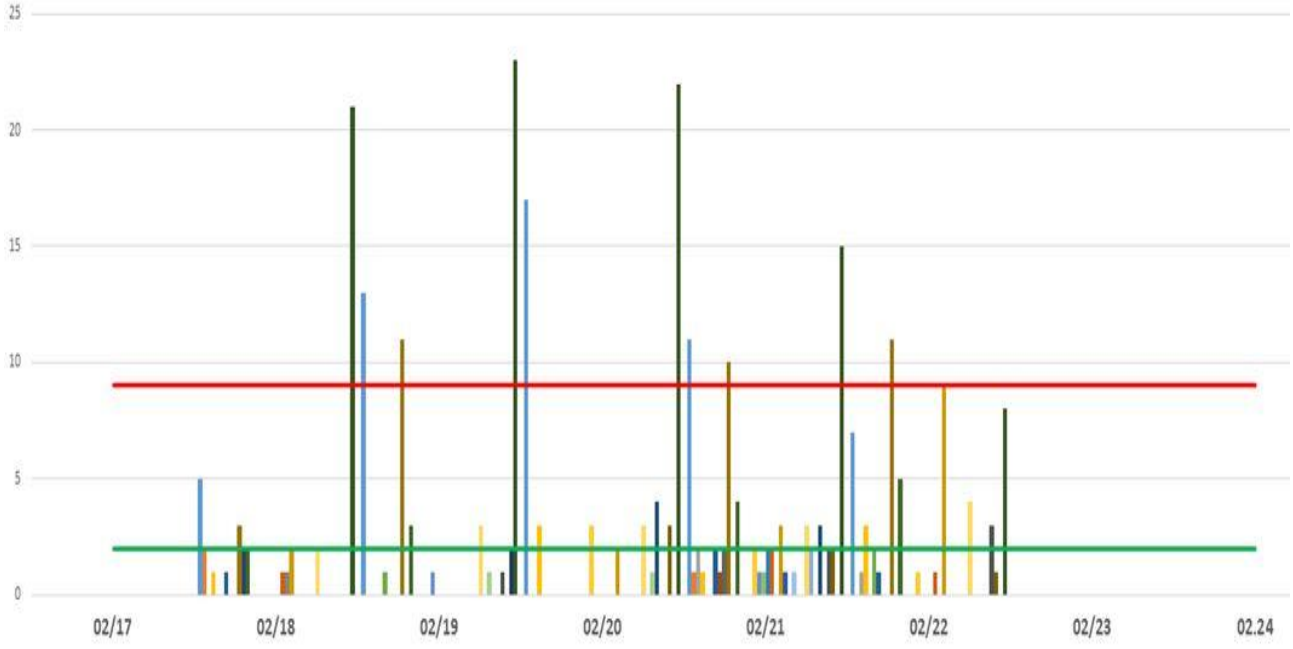

Figure 1. Manually Collected Data Graphs

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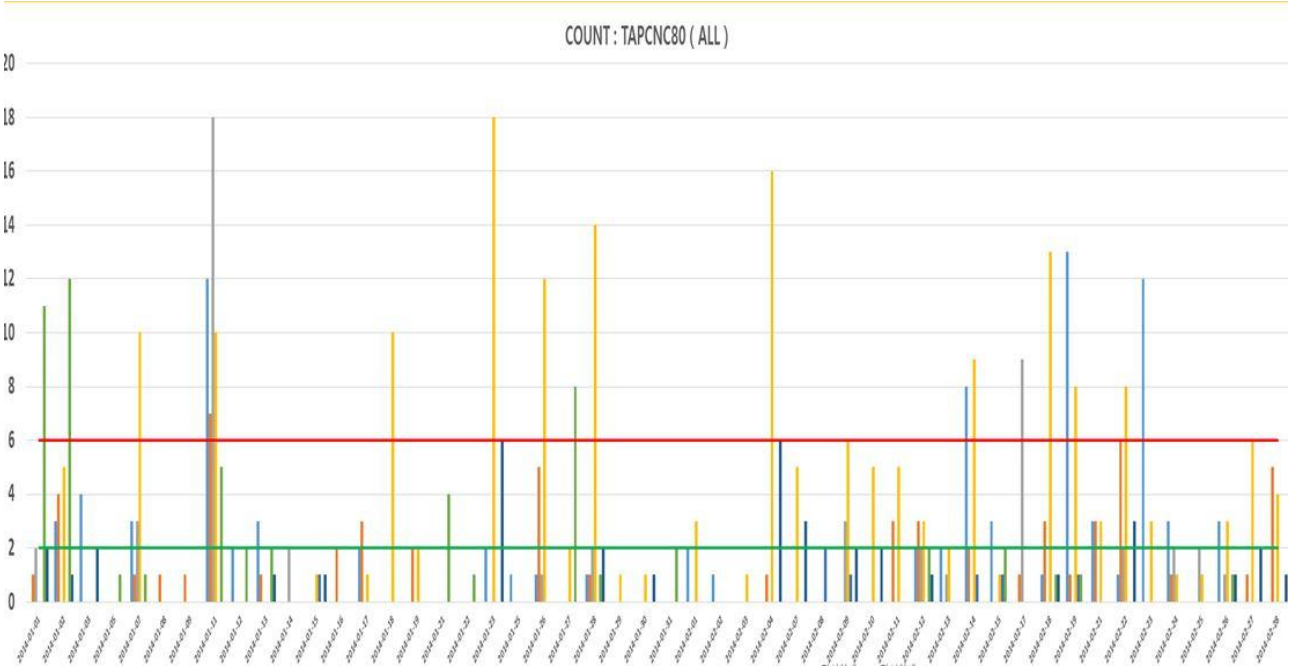

Figure 2. Automatically Collected Data Graphs

IV.CONCLUSION

Instantaneous stop is classified according to equipment and function, and then the standard value is set for each alarm ID or function part, and the convenience of the user is set up. Semi-chronic type (E1), Chronic type (E2), and Unexpected type (E3) can be calculated with respect to the instant stopping time, stopping rate, operation time, operation rate and operation cycle for each facility and function. The information provided by the instantaneous stop analysis system proved that the proposed method can be improved step by step in the order of Semi-chronic type, Chronic type, and Unexpected type. In order to solve the instantaneous stopping problem, this study was divided into Semi-chronic type, Chronic type, and Unexpected type. In addition, we have provided the information to be presented in the analytical system and the basis for the refinement of the granular instantaneous stop through the case of application to the industrial field.

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