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Automation of Supervisory Service, and Examination of the Subject of Operation

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Abstract: The entrepreneur who offers surveillance as a service is advancing automation of surveillance as a means of a productivity improvement. However, the surveillance operator becomes to have a difficulty on complex alarm. If some information was shown to the operator on standby time, he can expect alarm, and perform smooth disposal. As a result of building the environment which imitated surveillance and experimenting using a subject, the disposal time of alarm was shortened. In the specific subject, the disposal time was shortened 48%. By this experiment, the validity of the prior support function before alarm occurrence has been showed.

Keywords: Supervisory Service, Service Engineering, Human Interface

1. INTRODUCTION

Surveillance is performed to maintain continuously the system which consists of various apparatus and networks. The entrepreneur who provides service may maintain a system at low cost, outsourcing to surveillance is not rare.

The entrepreneur who offers surveillance as a service has the equipment which supervises intensively, prepares some operators, and carries out the surveillance on 24/7 [1]. The entrepreneur of supervisory service is advancing rationalization of surveillance business, and realizes the courtesy rates which raise their productivity and are competitive while he provides service to two or more customers.

The one methods of the rationalization is automation of surveillance. In this paper, the subject which occurs in the operator by advancing automation, and a proposal of solution is showed.

2. SUPERVISORY SERVICE AND OPERATION

2.1 Structure of supervisory service

Supervisory service installs some probes in target systems for surveillance, and collects and supervises them in the surveillance center. Change of the state will notify as a message to the surveillance center with these probes. An operator of the surveillance center carries out correspondence to a message according to the manual defined beforehand.

2.2 The classification of messages

Messages from probes are classified into three, according to ITIL v3. These are "exception", "warning", and "information" [2]. By the contents of the message, this classification is obvious or can be performed along with a definition of manuals.

"Exceptions" is a failure of the apparatus which has influence on the service provided by the system, an abnormal end of the software in apparatus, etc.. Recovery from failure is performed according to the procedure shown in a manual. For example, in failure of equipment, directions of exchange may be given to a worker. In the abnormal end of software, reboot is performed by an operator.

"Warning" tells the state for which service may be affected if it is neglected. For example, there are a state which exceeded the threshold value of resource consumption. An operator improves the state of a system according to a manual.

"Information" tells the change of state of the system which does not have influence in service. An operator records of a phenomenon, etc.

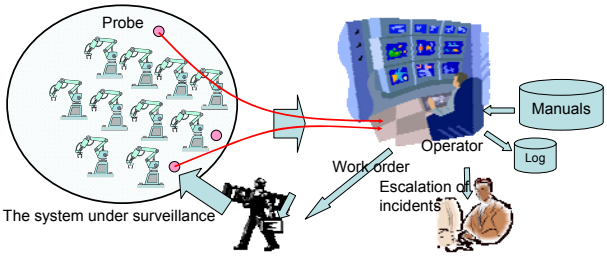

Fig.1 The system and surveillance operator

2.3 Difficulty of operation

Since it deals with the message which a probe detects according to a manual, there must be no difference in difficulty for an operator. However, the manual which includes all phenomena beforehand cannot be prepared. Moreover, it is not rare to expect operators' implicit interpretation and operation. For disposal of some messages, the operator will need to ask the designer of the system, or the network provider. To find contact information, or thinking to understand the configuration of the system, are difference between the degree of

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difficulty.

An operation about degree of difficulty is high, the frequency of occurrence is low. When the difficulty of operation was classified into five steps along with the time which processing took about 15,000 messages processed at the half a year of a certain supervising system, each generating frequency became like Fig.2. Difficulty is set up like Table 1.

These processing times are each lapsed times after a message occurs until processing was completed. The working hours have correlative with these time, but these are not the working hours themselves.

Table.1 Operation difficulty and Processing time

Difficulty	Processing time
1	< 15 min.
2	< 2.5 hours
3	< 24 hours
4	< 10 days
5	More than the above

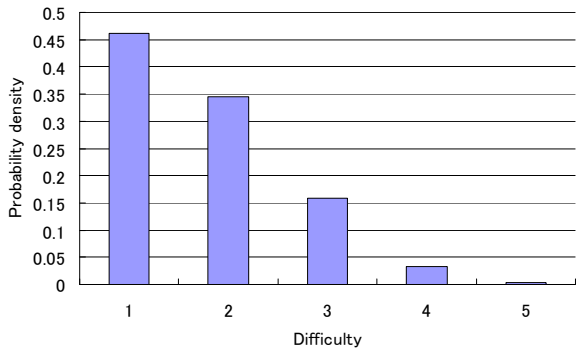

Fig. 2 Operation difficulty and probability density

Considering this difficulty, the correlation with the classification of the message shown above is low. The "exception" which caused the stop of service Failure is primarily a stand-alone equipment, and has clear description in the manual about the operation. On the other hand, the "information" or "warning" is not often described a procedure in the manual. Therefore, it will take time until an operator decide to operation.

3. AUTOMATION OF SURVEILLANCE

3.1 The purpose of automation of surveillance

Automation of surveillance is positioned as part of rationalization of the supervisory service. Since the manual which defines the occurring message and operation is drawn up in providing supervisory service, the contents of surveillance business are clear. If the contents of this manual are performed automatically, for example by a computer program, an operator's work will be reduced. By the automation, the expansion of services is possible. (Fig.3)

Also, service levels will improve by shortening the disposal time [3], [4].

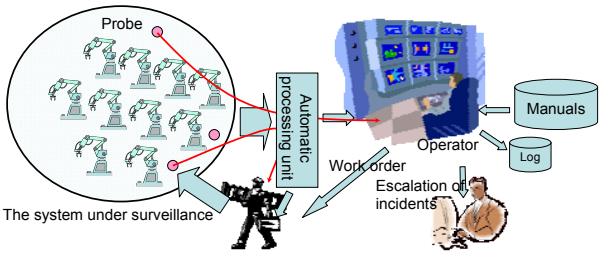

Fig.3 Automatic processing for surveillance

3.2 Automation and surveillance operator

Comprehensive procedure manual that corresponds to all events does not exist, but a surveillance operator is required. Moreover, even if it writes in the manual, it cannot deal with all automatically. For these reason, as shown in Fig.4 among distribution of the difficulty of operation, an easy thing like the difficulty 1 and 2 will be automated. Therefore, what has high difficulty remains as the operator's operation.

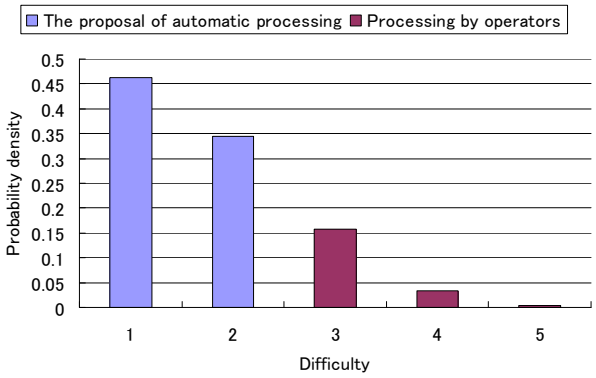

Fig.4 Operation difficulty and probability density

4. THE SUBJECT IN AUTOMATION OF SURVEILLANCE

4.1 Mobiligence and surveillance business

In Mobiligence, the relation between human and environment was showed like Fig.5. [5] The system for surveillance is applied and considered by the environment of this figure. The message treated under surveillance in this model is equivalent to the arrow to the "Sensing" from "Environment" of 2. "Intelligence" also acquires the information from "Sensing" and acts on the arrow 3 to "Action". Since automation will place a machine between the arrows 2 and a filter will be covered, the information on the arrow 3 to "Intelligence" also becomes thin. Therefore, " Intelligence" when automation is applied, is equivalent to automation before.

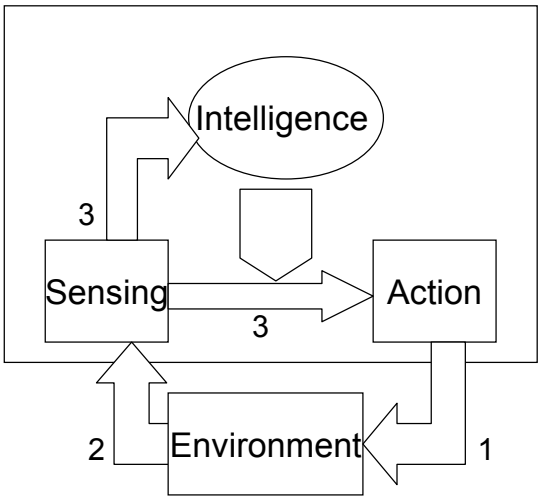

Fig. 1 A concept of Mobiligence

4.2 Brain activity and surveillance business

Surveillance is the consciousness to an environmental change. It is thought that a limbic system and the brain stem are concerned with this consciousness. If the perceived phenomenon does not expect, a limbic system will transmit a negative signal to the cerebral cortex. Moreover, to cancel this displeasure, the signal which searches for environment is transmitted. As a result, the increase in line strain, the increase in perspiration, pupillary dilation, the increase in cardiac beats rate, etc. occur. If it is the phenomenon which the perceived phenomenon expected, a positive signal will be transmitted to the cerebral cortex. This is in a state without the stress where the autonomic nervous system was stabilized. This prediction is estimated by the limbic system, is not based on the technical knowledge of apparatus or a system, and is intuitive judgment.

There is a report that the reaction of the way accompanied by an active act becomes quick [6]. This is considered as follows. A worker predicts the phenomenon which occurs by active acts, such as search. By this prediction, even if it discovers something, it can respond without stress.

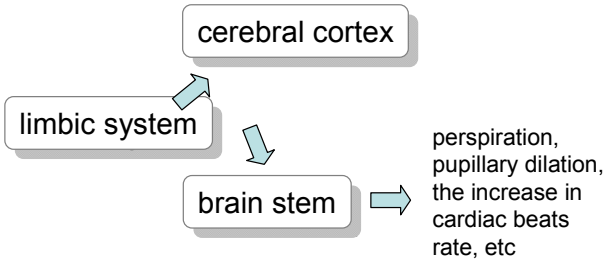

Fig. 2 Surveillance operation and brain

4.3 Subjects which occur by automation

Although automation of surveillance looks rational apparently, the following subjects occur.

- Decrease in the opportunity to perceive the target system:
  It is difficult for an operator to cope only with a difficult phenomenon. The number of messages per one system to which the operator corresponds decreases by automation. However, the opportunity for the operator to perceive a target system through an easy phenomenon is also decreasing. If the education to an operator is increased in order to correspond to this [7], it will be the increase in employment cost.
- An operator's activity nature:
  Fundamentally, the surveillance of a system is passive for an operator. The probe is checking the state of apparatus actively. However, this is not visible to an operator. When the present passive surveillance is considered along with work of a brain, many messages will be treated as a negative phenomenon and will be processed under a high stress.

5. PROPOSAL OF SOLUTION

5.1 The model of a system

We propose the model of the surveillance business which has activity nature to an operator (Fig.7). In this model, an operator has the function to search for the target state, with the automatic processing capability of a phenomenon.

In order to carry out automatic detection of the change for surveillance, its detection accuracy does not improve by an operator's search. However, the opportunity for an operator to perceive an object by this search function is obtained. It becomes possible to maintain the throughput over the phenomenon in which difficulty is high, by this.

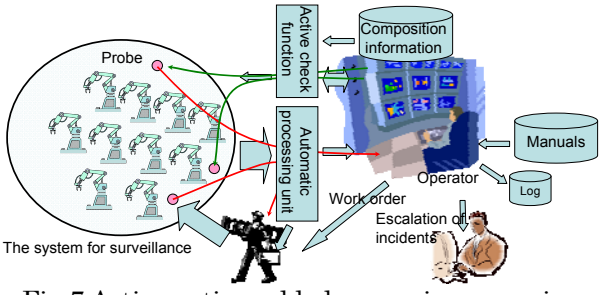

Fig.7 Active action added supervisory service

5.2 Extraction of active working time

It needs to avoid that the time which can respond to the phenomenon which occurred decreases by active work. Phenomena, such as failure, have random nature. Therefore, it is necessary to manage the time to the completion of disposal to maintain a service level. For example, when there is an operator and average processing time is managed by degradation of less than twice, the operator's operating ratio will be 50% or less. The calculation of this can be made by Queuing theory. An operator's operating ratio is managed at 50 to 70% in many cases. Therefore, 30 to 50% of office hours is in

the state which is waiting for the phenomenon. It is possible to apply this time to active work. Thereby, an operator does not reduce the time corresponding to a phenomenon.

5.3 Cases of active business

The reliability for surveillance is not uniform and taking the curve called a bathtub curve to a time series is known. Moreover, the system which detects the omen of failure from change of the performance characteristic of apparatus also exists. An operator is made to peruse such a figure, the disposal method when a phenomenon occurs, etc. By this, an operator gets an opportunity to expect the phenomenon which may happen.

In addition, it is not indispensable that the phenomenon about the information which the operator perused occurs immediately since expectation is performed by a limbic system.

6. EXPERIMENTS WITH SIMULATED ENVIRONMENT

6.1 Simulation environment

We built the imitation environment of the supervising system using a computer, and carried out measurement using several subjects.

A subject waits for alarm, seeing the screen of a computer. Alarm is generated at random and the average of the generating interval is 25 seconds. Generating of alarm will display alarm on the screen which the subject is looking at. A subject will click the button on a screen, if alarm is perceived. The time from alarm generating to this click is initial time. The screen of disposal to alarm is displayed by this click. A subject opts for disposal according to the contents of the screen, and clicks the button on an applicable screen. The time from the display of disposal to this click is disposal time. (Fig.8). If disposal is completed, it will return to the state of waiting again. This sequence is repeated 20 times per test. The number of the apparatus for surveillance is 1000. There are three kinds of generated alarm and disposal is three kinds. This combination is generated for every test.

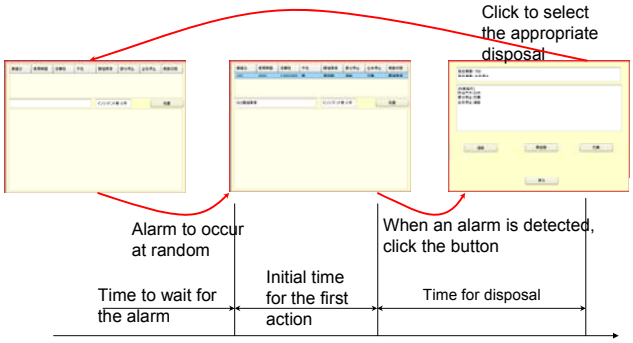

Fig. 3 Sequence of the experiment

6.2 User Interface

The screen where it waited for alarm prepared the following two kinds, in order to do the test whose subject waited for alarm passively, and the test which a subject could search for the candidate for surveillance actively.

- Passive (A)
  Additional information was not expressed as a passivity type waiting screen until alarm was generated. Generating of alarm would display the information on the apparatus generated on the upper row of the screen. A subject would click the button of disposal, if the display of alarm was recognized.
  The example of a screen when alarm was generated in Fig.9 is shown.

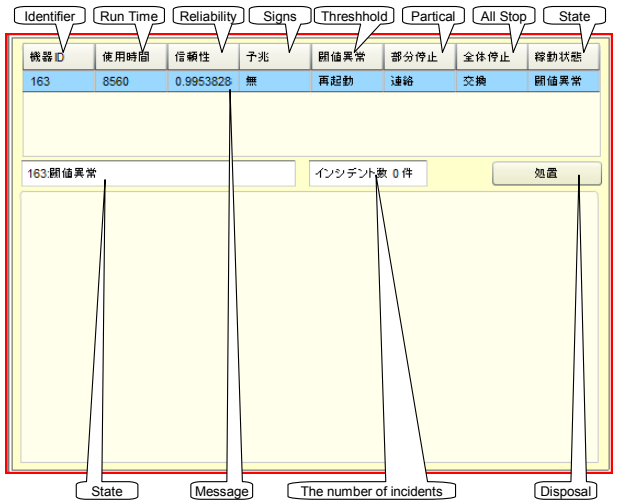

Fig.9 Passive waiting screen (A)

- Active (B)
  The list for surveillance was always expressed in the lower part of a screen as an activity type waiting screen. While waiting for alarm, the subject could scroll this list or could sort a list by items, such as apparatus ID and an hour of use.
  In addition, an hour of use, reliability, the contents of a display of the item of signs, and the possibility of the apparatus which alarm generated had not taken correlativity in this imitation environment. In a real system, although it was an item which had generating of alarm and correlativity statistically, in the alarm of 20 by which a subject corresponded, it did not become a significant difference by this imitation system.
  The example of a screen when alarm was generated in Fig.10 is shown.

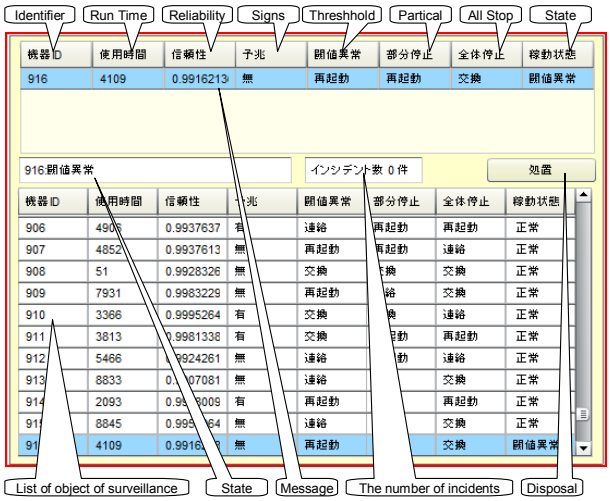

Fig.10 Active waiting screen (B)

7. EXPERIMENTAL RESULTS AND DISCUSSION

7.1 Subjects and results

The result measured about five subjects is as follows.

10 alarms of the second half of the 20 alarms was being used for data, in order to eliminate the influence of the mastery to operation.

Graf of fig.11 shows each average times. (A) shows a passivity tape. (B) shows an activity type.

7.2 T-Test

The T-test was carried out to evaluate results, whether a passivity type and an activity type have a significant difference. The result is shown in Table 2.

It was rejected that the item whose value of a table was smaller than 0.05 was the same distribution.

Therefore, the subject 2 and the subject 3 can say that time distribution differs with a passivity type and an activity type.

Table 2 Result of T-test

	First Action	Disposal
Subject1	0.177	0.092
Subject2	0.055	0.028
Subject3	0.898	0.000

7.3 Evaluation of the results

About the average of initial time, activity type time is shortened except for the subject 1. However, this difference is not accepted to be a significant thing by the T-test.

About the average of disposal time, activity type time is shortened. It is admitted that this result has a significant difference about the subject 2 and the subject 3 as a result of T-test. In the subject 3, disposal time is being shortened to 48%, and an effect is remarkable.

Distribution of the disposal time of the subject 2 and the subject 3 is shown in an appendix. It is in the tendency of shortening to activity type time distribution.

In this experiment, the activity type showed the subject the list of 1000 affairs. It is difficult for a subject to memorize these. It is possible

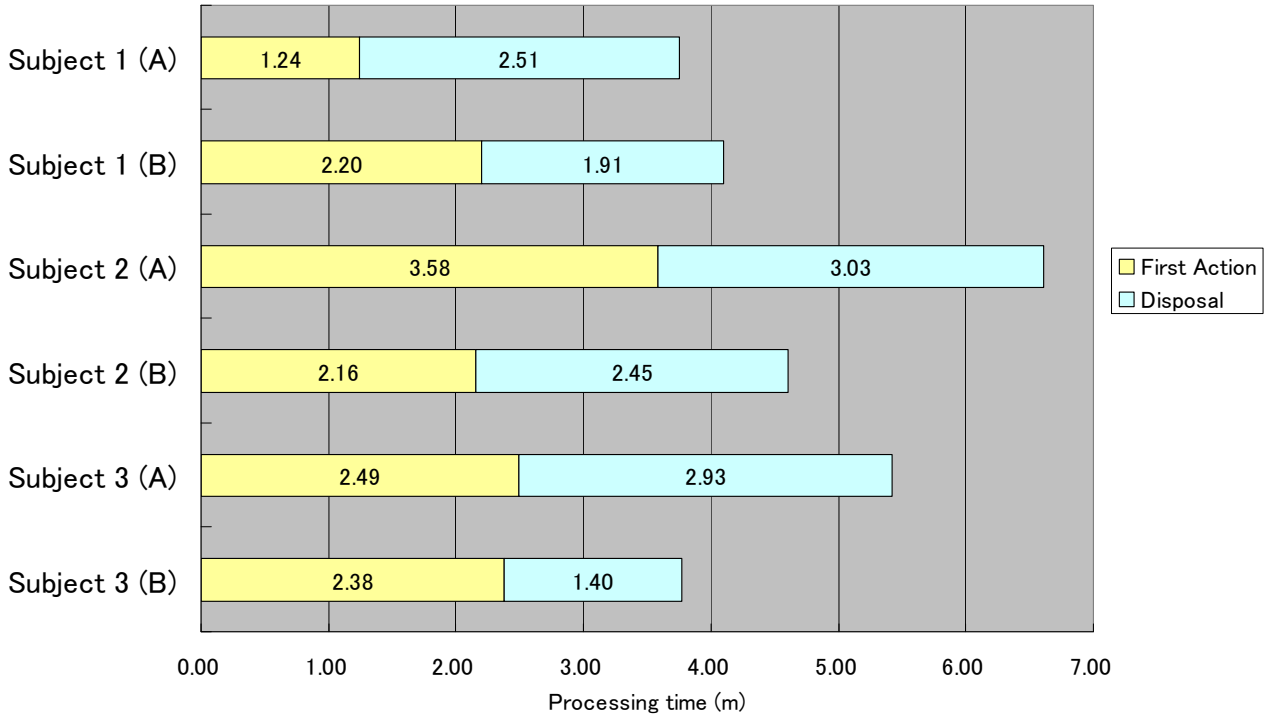

Fig.11 Processing time of the experiment (Average)

that this list influenced prediction of the limbic system as impredicative memory.

8. FUTURE WORKS

We considered that the method of a proposal was effective in shortening an operator's disposal time.

However, the following matters are not clear, and it is necessary to try / evaluate them continuously.

- Relationship of the measured phenomenon and brain activity
- Influence of diverting waiting time to operation

Measurement of physiological change of a subject's working hours, a subject's line strain, perspiration, a pupil, cardiac beats rate, etc. can estimate these.

It clarifies by retesting in the environment in which physiological measurement is possible.

7. CONCLUSION

The automation performed by a part of rationalization of supervisory service has a possibility that an operator may decrease an opportunity to perceive a target system and may reduce an operator's throughput. As solution, it is possible to take in an active act to operation.

The system which imitated surveillance was built and it checked that an operator's disposal time could be shortened by including an active act in surveillance. Evaluation of the method of a proposal is due to also measure a subject's physiological reaction.

APPENDIX

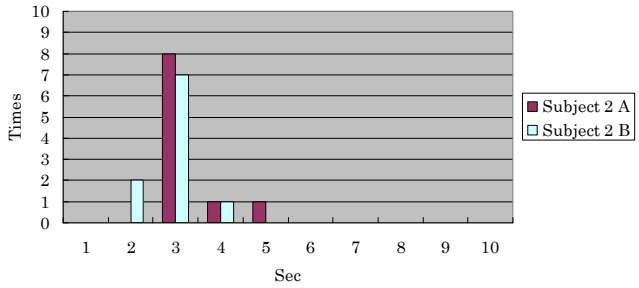

Fig. 4 Histogram of disposal time (Subject 2)

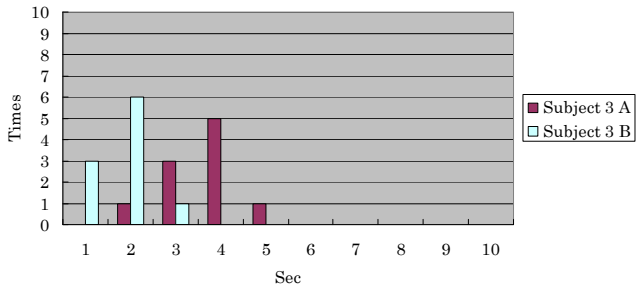

Fig. 5 Histogram of disposal time (Subject 3)

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