Process Evaluation Model based on Goal-Scenario for Business Activity Monitoring

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Abstract— **The scope of the problems that could be solved by monitoring and the improvement of the recognition time is directly correlated to the performance of the management function of the business process. However, the current monitoring process of business activities decides whether to apply warnings or not by assuming a fixed environment and showing expressions based on the design rules. Also, warnings are applied by carrying out the measuring process when the event attribute values are inserted at every point. Therefore, there is a limit for distinguishing the range of occurrence and the level of severity in regard to the new external problems occurring in a complicated environment. Such problems cannot be abstracted. Also, since it is difficult to expand the range of problems which can be possibly evaluated, it is impossible to evaluate any unexpected situation which could occur in the execution period. In this paper, a process-evaluating model based on the goal scenario is suggested to provide constant services through the current monitoring process in regard to the service demands of the new scenario which occurs outside. The new demands based on the outside situation are analyzed according to the goal scenario for the process activities. Also, by using the meta-heuristic algorithm, a similar process model is found and identified by combining similarity and interrelationship. The process can be stopped in advance or adjusted to the wanted direction.**

Index Terms—**workflow system, adaptive business process, business activity monitoring**

I. INTRODUCTION

AS the software is being used in a variety of environment, the information system in the enterprises now require Adaptive business process management in order to cope with environment that was not anticipated in the beginning. In such a point of view, the process is receiving a lot of attention as a core element for the realization of the business activity monitoring (BAM) process [1][2]. In order to make an effective BAM environment, it is necessary to clearly identify and analyze not only the monitoring process regarding the internal situation in the design process, but also the demands which occur outside. It is required to evaluate such things by securing the right technique and process for the analysis. However, it seems that the event-managing monitoring system [3], which analyzes the correlation by using the current rule-based method, and the real-time advanced alarming business monitoring system [4], which applies the measuring process by using the decision-making tree at each point when the event attribute values are inserted, do not have the model and method which can be used for the prediction of results in the goal process in most cases by assuming a fixed environment. Also, warnings are applied by carrying out the measuring process when the event attribute values are inserted at every point. Therefore, there is a limit for distinguishing the range of occurrence and the level of severity in regard to the new external problems occurring in a complicated environment. Such problems cannot be abstracted. Also, since it is difficult to expand the range of problems which can be possibly evaluated, it is impossible to evaluate any unexpected situation which could occur in the execution period.

In this paper, a process-evaluating model based on the goal scenario is suggested to provide constant services through the current monitoring process in regard to the service demands of the new scenario which occurs outside. Based on the goal scenario base, new demands based on the external state are divided into the components of the business technique. Then, the common activities are analyzed. Also, by using the meta-heuristic algorithm, similar process models are found. By combining similarity and interrelationship, the level of appropriateness is identified prior to the application to the business monitoring process.

II. RELATED WORK

A. existing business activity monitoring

The business monitoring process can be executed by the event-managing monitoring system, which analyzes the correlation among various events by using the rule-based method, and the monitoring system, which can be used to measure the level of danger for the business process in real time. The rule-based system [3] extracts the essential factors which cause the results of the process

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to be terminated in an abnormal way based on the information of the past process. The rule is expressed in 'If (condition) – Then (action)' [5]. If any factor which causes the abnormal results appears, the system detects it and executes the alarm process. The function of the rule-based alarm system is decided according to the accuracy of the 'If-Then' rule. Also, it is possible to decide whether to execute the alarm process or not according to the measurement of similarity with other essential factors causing danger [6]. Even if it is easy to repair and maintain such a system, it is difficult to indicate the level of danger in real time according to each stage of the process. Generally, it is impossible to measure the level of danger through the rule-based system if there is no event which is subject to the condition of the rule at a certain point in the process. It is only possible to decide whether the condition of the rule is met or not when a relevant event occurs. Therefore, since the alarming process is executed only after a factor causing the abnormal results of the process occurs according to the principle of executing the alarming process when the previously-defined rule is detected, the efficiency of the real-time monitoring process could decline.

The real-time advanced alarming business monitoring system [4] applies the measuring process by using the decision-making tree at each point when the event attribute values are inserted. By executing the alarming process when the level of danger exceeds the marginal value, it is possible to execute the alarming process earlier than the current rule-based system by predicting the factor causing danger in advance. However, the credibility regarding the level of danger gradually increases towards the end point of the process, while it decreases with a relatively small amount of information. Also, since the evaluation process is not executed by considering the correlation among events or the importance of each event, it is difficult to accurately measure the level of danger.

Therefore, there is a limit for distinguishing the range of occurrence and the level of severity in regard to the new external problems occurring in a complicated environment. Such problems cannot be abstracted.

B. existing process evaluation method

In order to realize the BAM, the current methods suggest a model for the measurement of achievements in the process for the evaluation of the current achievements in advance in terms of a management viewpoint. Luckham [7] uses the information for the correlation of events to define the event poset( ) in order to realize the combined event management. Also, based on such a process, the system prototype has been suggested by considering the results of the study about event patterns, extraction and combination. Sonnen [8] has suggested the event-based tool of TIPCO for the solution of the problems related to the business achievement management in the business factor platform. However, since such methods focus on the low-level event monitoring process which can only be used for a simple diagnosis, it is still necessary to study the process achievement measurement. Such architectures as ARIS [9] and FileNet Process Analyzer [10] can be used to clearly collect and organize complex events through the process viewpoint. Also, they can be used to carry out a real-time analysis process in order to complete a report in terms of the process viewpoint. However, they still have a limit regarding the monitoring process for the problems which occur in various information systems.

Such current studies only focus on the evaluation of the measurement process for the achievements which are suitable for the operational objective of each subject process by assuming a fixed environment and extracting and evaluating a process in the course of analyzing the demands. In order to respond to the unexpected environment in the initial period, it is necessary to analyze a new goal process through the process viewpoint. Also, it is necessary to identify important factors by connecting the process with the events in various information systems, while evaluating the possible application on the current process.

III. PROPOSED SCHEME

In this paper, a process-evaluating model based on the goal scenario is suggested to provide constant services through the current monitoring process in regard to the service demands of the new scenario. To manage the unexpected demands in the outside environment during the monitoring process, it is necessary to carry out the analysis process for the demands based on the goal scenarios in the planning stage before creating scenarios. Such completed scenarios can be used to analyze the operator type for the common process activities and define and classify the groups of activities before creating the goal scenarios which would be subject to the monitoring process. Through the meta-heuristic algorithm, the process model which is similar to the current process is found in order to identify and evaluate the relevance by combining similarity and correlation. Through such analytic information, the process for new demands can be stopped in advance or adjusted to a certain direction through the business activity monitoring.

A. external situation analysis

In this thesis, it is assumed that the detection of new demands occurs due to the user's insertion of values. Therefore, no other statement would be provided.

Therefore, this chapter describe the analysis for new requirement that occurs through the detection of external situation .

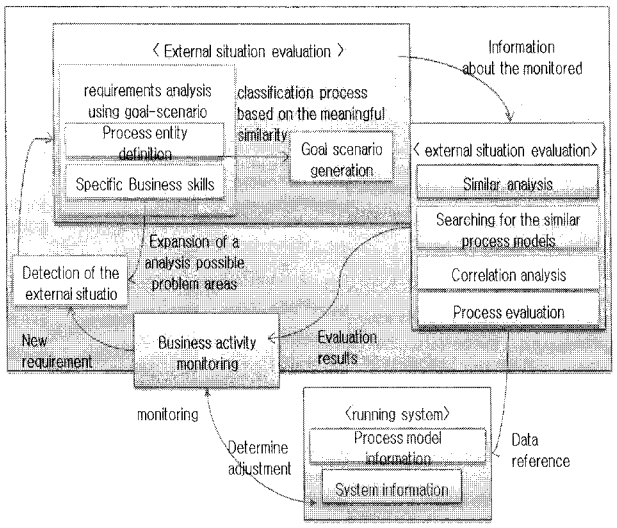

Fig. 1. Framework of process evaluation model based on goal-scenario

1) requirements analysis using goal-scenario

By using the process management system, this time the goal requirements that are in need of changes as a result of the analysis on the new scenario are identified. The objective of each demand can be achieved by combining and implementing several business processes together. In other words, the abstract goal demands are extracted by defining business scenarios in order to achieve the goal demands. Also, by establishing solutions for the problems extracted in the stage for the analysis of demands, it is possible to reflect them in the goal business process.

When an analysis on the requirement by the objectives is done, if the analysis is made only based on the user type, there is an advantage that the tasks are allocated in a very clear and explicit ways to specific individuals. But, as the allocation is happening upon a certain individual only, the flexibility in the middle of the process to cope with the changes is lost. When the analysis is made by the role types, the system has the flexibility to allocate the tasks to a group of people doing the same kind of jobs. But, it is not suitable to pick specific individuals to a certain task.

Therefore, according to each purpose with the type of the role, the type of the user has been considered by analyzing the goal scenarios.

TABLE I
BUSINESS SKILLS

Goal	Scenario	Activity	Entity name	Description
G (new goal requirement)	S (Scenario Abstraction for goal generation)	A (Activities for achieving the goal)	RE (resource entity) & EE (Event entity)	The definition of each extracted entity

The business skills are used to determine new goal demands within a business together with the suitable scenarios, activities, resource entities, event entities and description (Table I) for the creation of objectives. The resource entities can be used to extract such real bodies as humans, items, places and companies which are required for the business activities. By identifying the activities which compose business activities, it is possible to find out the event-related entities. The definition of each entity focuses on the reason why such an entity is made.

TABLE II
SPECIFIC EVENT-CLASSIFYING CATEGORIES OF THE EVENTS BASED ON THE GOAL SCENARIOS

activity of scenario according to goal requirement(A)	Data-based events(GDE)	The events which are based on the insertion and selection of data
	Process-based event (GPE)	The events which occur according to the execution of the process in terms of the begin ning and the end of the activity
	Legacy systems based on event(GLE)	The events which occur due to the operation of the current system in a business or the previously-defined business rule
	External events(GEE)	The events which are based on the system or environment outside of a business

In order to apply the monitoring process for the demands of the objective, it is necessary to have more than the business skills of the plan. The activities which occur in the workflow management system can be diverse in terms of data and events, and occur countlessly in a short time according to different viewpoints. The events which could occur between the beginning and the end of one process instance can be largely divided into four categories as shown in (Table II) based on the different causes for the occurrence of the events. The objective of such a process is to clearly identify the information of each activity and the related events in regard to the demands of the objective.

2) Generation of Scenarios based on the Analysis of the Objective and the Business Skills

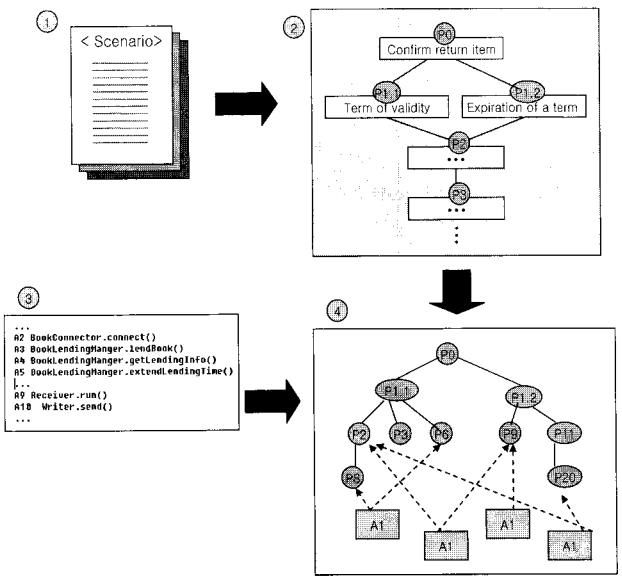

Fig. 2. Extraction of Information based on the Goal Scenario according to the Analysis of Business Skills

The goal scenarios are generated by considering the information of business skills for the goal scenario-based process and various kinds of information related to the specific categories for the classification of the events. Each scenario generated to solve specific problems describes the scenario abstract by carrying out the classification process based on the meaningful similarity and creating the upper objectives mainly based on the common process or role.

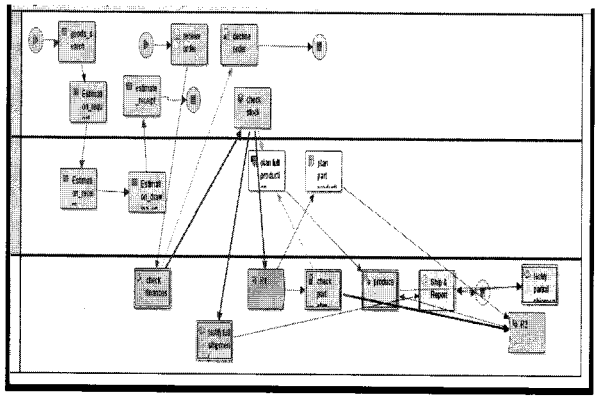

Fig. 3. Example of goal-scenario generation

B. external situation evaluation

1) The analysis of the similarities in activities for the goal- requirements

Based on the process model for the goal requirements, the analysis is done not on the entire relations between the activities of the existing process. But, instead, the analysis is only performed on the required sets of information with the vector-space model similarity method to find out the existence of the activities, in order to apply a change onto it.

Where the model for the goal requirement is S $\in$P, and the activities are shown as i, Aj $\in$ N, Ai $\neq$ Aj. In this model, S is the process model for the goal requirements, while P is the set of the all possible process model.

$$P_j = (a_1, a_1, \ldots a_n)$$

$$S = (t_1, t_1, \ldots t_n)$$

GA calculates the similarity of the goal requirement process by judging the existence of the activities. Where an appearance is detected within the existing activities, the value is 1, otherwise the value is set to 0.

$$GA: a_{ij} = \begin{cases} 1 (when\ t_i\ from\ S\ is\ detected\ within\ P_j) \\ 0 (otherwise) \end{cases}$$

$$Sim(P_j, S) = \sum_{i=1}^{n} (GA : a_{ij}) \quad (1)$$

The number of the activities of the objective based process is set as NS, and uses the values of the activities in the existing process calculated in (1) to judge the similarities of the activities (ASD) by applying the equation shown below.

$$ASD = \frac{Sim(P_j, S)}{NS} \quad (2)$$

The ASD value is used to identify the relevant process, and the bigger the value is, the higher the priority is. When the value is 0, it means there is no process that fits in the goal requirements of the existing process. So, the process has to be newly initiated. The search is to be made in the order of higher rank of ASD, and the analysis on the relations between the activities is conducted.

2) Searching for the similar process models

In accordance with the ASD value amount, the activities chosen from the entire model is sought. After that, the relation value of the activities is calculated to get the relevance to find out whether there is a need for a change. Firstly, a search for a similar process model is done based on the process model activities. (Fig. 4) simply describes some of the goal scenarios (S) according to the order of priorities since all of the activity NS for the goal process is included with the same ASD value. The parts between S1 and S3 below (Fig. 4) show some of the results for the similar process model.

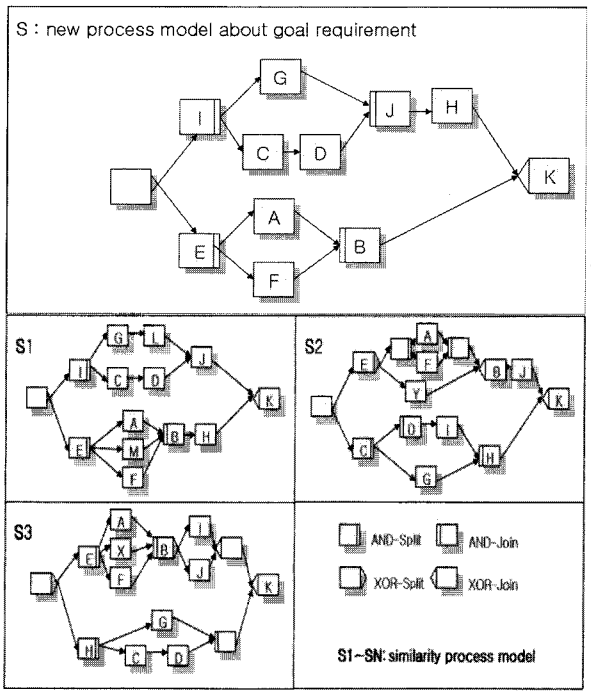

Fig. 4. Similar process model

But, Even if all of the ASD values are high, the time taken for processing the process information is too long to be used as the relevant process model. So, it becomes

necessary to find a more relevant model by figuring out the circumstances of the activities.

3) Activity relation analysis based on the similarity result

Based on the activity similarity values on the goal requirement, there is a hierarchy given to find out the dependency in accordance with the activities' event relations. To figure out the dependencies, an order matrix is drafted based on the data information storage where the detailed event items' information is stored along with the business description at the planning stage of the monitoring process. The matrix is to be drafted with the genetic algorithm. It is to be organized in the form of $A_{|M| \times |M|}$ and controls 4 different types of (0, 1, *, -) elements. N herein means the sets of the activities.

- When Ai appears before Aj, the value is 1.
- When Ai appears after an Aj, the value is 0.
- If Aj has at least one trace either before of after it and included in other parallel (And-block), the value is *.
- If Ai nor Aj does not have a trace and include in other parallel, (XOR-block), the value is -.

Using the four types under control, the process model in accordance with the goal requirement is shown in a matrix (Fig. 5).

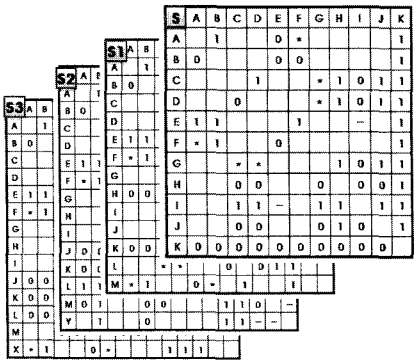

Fig. 5.The Order matrix of the similar process model

The dependency increases the value of the correlation (ARD) if the value has the identical member from the 4 above in the same location by using the event property value and the process model within the objective process activities. So, when you find the appropriate process, the priority gets higher along with it.

After analyzing the relationship of the activities, the proper activities are selected to carry out the event-relationship analysis process by referring to the specific event categories in regard to the demands of the goal scenarios. Even if the event-relationship analysis of the activities in this thesis does not provide specific information, the analysis process is carried out by assuming that all the events which occur due to the process instance are known.

IV. EVALUATION

It is checked whether the goal scenario process suggested to solve any unexpected outside problem can be applied or not by considering dependence and correlation. Also, it is evaluated how much the activities and the process are suitable for the goal scenario.

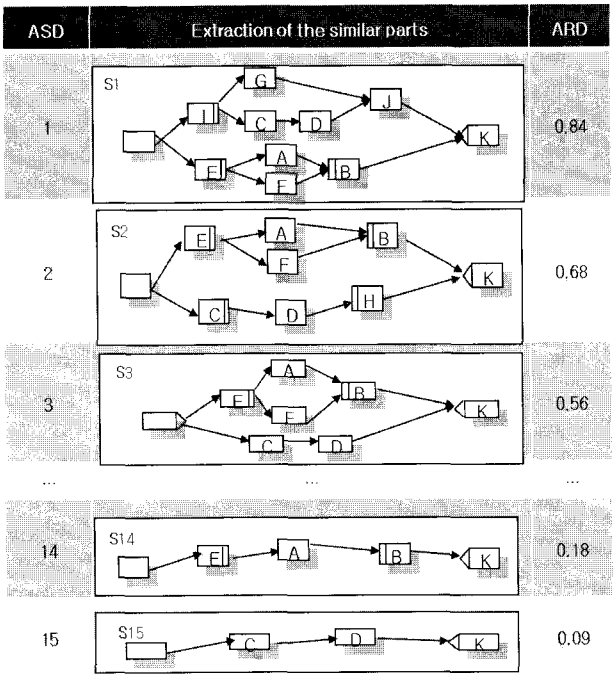

Fig. 6. Extraction of the similar parts by correlation

(Fig. 6) identifies correlation mainly based on the similar process model suggested in (Fig. 4) and extracts each similar part.

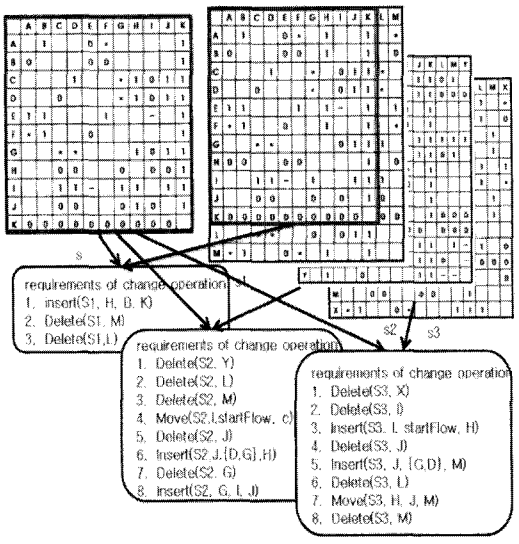

Fig. 7. Analysis evaluation for Goal scenario

If the goal process must include every activity which exists in the scenarios and the correlation with the current process is more than 50%, it would be necessary to make a change for the application. If the correlation is less than 50%, a new structure must be established. The evaluation results are shown in (Fig. 7).

(Fig. 7) uses the correlation order matrix to show satisfactory results for the process-evaluating index through the comparison with the current goal process. It shows the necessary works for the solution of problems. Such works can be extracted through the order matrix. The process with a high level of similarity requires less works for adjustment compared to the one with a low level of similarity.

Therefore, it is possible to make a change for the demands related to an unexpected situation by using the current process. Also, it is possible to identify the works which need to be changed according to the order of priorities. Such a result is sent to the monitoring process in process in order to provide the necessary information for constant services.

V. CONCLUSIONS

In this paper, a process-evaluating model based on the goal scenario is suggested to provide constant services through the current monitoring process in regard to the service demands of the new scenario. According to the change of the outside environment, the demands are analyzed by considering the goal scenarios prior to the creation of scenarios. The scenarios are completed by using the information about business skills. Through the components of the goal scenario-based entity, similarity and correlation are identified and evaluated.

Such information is used to figure out the problems occurring as a result of the changes and provide diagnostic information to support the adaptation decision making. With this, it is possible to apply the judgment of the situation info of the users as it occurs in a dynamic context.

Further studies would be desirable using the process evaluation information based goal-scenario as the basis to set up strategies in accordance with the adaptive judgment and expansion to allow rapid dynamic reconfiguration to meet the suggested requirements.

For such a purpose, more accurate information is provided by considering the correlation among the events composing the process or the importance of each event. Also, it would be necessary to carry out the study to provide various workflow services dynamically to the user.

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