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This year, we called for papers on Graphics, Image Processing and Intelligent Systems; High Performance Computing and Distributed Systems; Computational Science and Engineering; and Information Systems, together with Audit and Governance. ICAICTA2015 received a record 73 paper submissions from 9 countries including China, India, Indonesia, Japan, Malaysia, Oman, Pakistan, Saudi Arabia, and Thailand. We would like to thank the reviewers and program committee members for reviewing and working for the final paper selection. And a total of 51 papers were accepted which is represented a 69.8% acceptance rate.

We would like to express our sincere thanks to the honorable keynote speakers Dr. Keiji YAMADA, Head of NEC Laboratories Singapore, Senior Vice President, NEC Asia Pacific Pte. Ltd. and Dr. Ayu Purwarianti from Institut Teknologi Bandung, Indonesia for their generosity and informative speeches.

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We hope you find technical presentation and program useful to your research, enjoy the conference and explore Bang Saen, Chonburi, a beach near the capital of the Kingdom of Thailand.

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Automatically Relation Modeling On Spatial Relationship As Self-Adaptation Ability

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Abstract—**Self-adaptive system is a system that can take proper action automatically to reach its goal, based on the situation which occur at this system environment to meet satisfactory of its users. This paper would illustrate a case about self-adaptation function requirement in application tools that correspond to the requirement of graphic element adjustment function. One of the problems that can arise are related to connectivity function graphic elements, wherein when graphic elements associated with other graphic elements, elements of the relationship between the graphic elements can occupy the working area irregularly, even if there are other graphic elements that block the path relations, the relation element can penetrate into that graphic element. This condition has to rearrange by a user manually, so it is quite difficult and time consuming. Strategy that needed to overcome that problems, which must guarantee the availability of areas as working environment, as well as the appropriate decision-making mechanisms when determining an alternative option to connect between elements graphic automatically as self-adaptation ability. The solution for this problem, we propose strategy to automate relation space management of graphic element, as a result of an adaptation mechanism which more flexible and simplify users to do the job. Core concept that developed consist of two approaches namely free space management and neighbourhood modeling. These both concepts realised to polish up adaptation ability from tools limitation that exists at the current time.**

Keywords-automatic link modeling; spatial relationship; self-adaptation; free space management; neighbourhood modeling

I. INTRODUCTION

Self-adaptive systems (SAS) has been shown nowadays and become an alternative solution for problems and issues about system complexity. Including autonomy demanding, automation, adaptation, flexibility, scalability, agility, speed and so on. There are variety of notion about SAS definition, such as DARPA Broad Agency Announcement BAA-98-12, that cited by Laddaga and Robertson [1], give definition that SAS evaluate of behaviour its self and change its behaviour when evaluation show that software can't gain its goals, or when better functionality and performance can be done. This is showing that the software has several ways to aim its goal and has enough knowledge about construction to make effective behaviour transformation. Beside that, Ganek and Corbi [2] opine that SAS is system that automatically can take proper action based on its knowledge about what happen in the system which guided by goal, or stakeholder, or people that given access. Meanwhile, according to Cheng et.al. [3], SAS modification its behaviour to respond the change of system or environment.

According to above variety definition, inability context of application tools that involve its users, SAS can functioned as ability that automatically can take right action, based on its operational environment situation and guided by goal that must be achieve, with its primary goal to ease users to do the job. To achieve this matter, needed guaranty criterion as a key strategy to determine the representation of goal achievement alternative, and decision criterion to select specific behavior. As motivation to actualize the SAS ability, implementation from our proposed concept is illustrated into the example case that relate with application tools to graphic elements management, where problems that can occur when a user connect between graphic elements, element linker of each element can't adapt to working area availability and existence of other element, so condition from linker element become irregular, even can penetrate or ride to other elements when that element position on relation path. This condition cause a user have to rearrange relation element, even existence position of the graphic element that connected manually, in order to its connectedness become well-organized and neat. This matter correlate to two things, namely a factor of internal environment application (in context tools working space/ area) and the factor of tools element/ object itself. Here we propose two basic concept as an answer that need, namely the free space management concept that construct as model structure, and neighbourhood modeling that designed as relation automation to adaptation mechanism, so become self-adaptation.

The main contribution and final result from proposed approach is a self-adaptive framework, in form SAS concept implementation which is used in graphic application. Topic of this paper, start with related work, then basic conception that use as idea, and further about approach that developed and its implementation steps, and end with discussion and conclusion from studies that have been done.

II. RELATED WORK

There are many tools that used to help human for daily activities, today, including application as tools for modeling

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activity. Many application product has been released with offer ease to use and other advantages. Such as Microsoft Visio [4][5], in this application package, a variety of function provided to organize graphic element or better known with objects of the image maker. These objects mean, line, arrow symbol, circle, oval, rectangular, triangle and others. Variety of those objects could be used at the same time and arranged with many ways, so object connected each other. Even from a collection of objects that have been established, in case of additions or changes made by the user position, these objects will remain connected.

But, when the objects that involved in process have considerable amounts, and complex connection, then users will be faced difficult condition, since considerable amounts of object and interconnected, those collection of objects will make irregular form, even if one each other still connected. Instead from connection strategy and pattern or relationship that has been created, the embodiment of a collection of objects it becomes very inefficient and difficult for users to do their jobs.

Based on study and observed symptoms from drawback effect, accordingly the main problem of that application related with management of free space, it is means that area available in total area, but not the area occupied by the object blocks. Existing applications do not work in that area, but the management strategy is limited to blocks occupied area by the object, so it appears deficiencies as discussed. In this paper, we propose an approach related to the management of the free area, where each object can be automatically and dynamically adapt to search for and find their own relationship, albeit with considerable amounts and the needs of its relevance.

III. AUTOMATION CONCEPT OF ADAPTATION

Before further explanation about a concept that could used as problem solution. Let's equate our perception about the area. In a job area related to setting image objects, we can define two different areas, namely free area and unfree area. Unfree area is area that use by the object as a block where the object is located, called black block, meanwhile the free area is a region between object blocks that unused by object, called white block.

Approach that we propose is a relation warranty to the free area, so that relation placement can ensure relation process that occur automatically, when plot of content is changing, in amount or its position, as a form of adaptation mechanism object when filling the free space. There are two basic concept used to create it, which is: (a) free space management, is a free area that organized become a model structure, and (b) neighborhood modeling is every object block that defined have four neighbors kinship.

Free space management started with determining and fragment handle of the available free area, so that when a relation commit block searching as objective target, will search the free area fragment structure, with considering white block capacity or available free area. This is committed in order to object as relation which would enter into a particular free area can be organized, so that the object composition in free area becomes relevant, or not overlapping or object not in irregular form.

On existing application, block has relation when those block is connected with other block, and relation connector limited at a point that stand in the center of every side block. In neighborhood modeling, proposed concept is every block will be modelled with scenario that as though has relation at every wind direction, before or after that relation is connected, and relation connector is not limited to a connector point. But, relation connector designed can adapt dynamically, so can show up along block side when needed. When those block will be connected with another block where ever it position, then that relation will follow fragment of the free area that arranged as structure. Input of this system consists of two things, namely (a) block list, and (b) relation list, both will be used as reference for adaptation mechanism, namely automation dynamic moving from every relation that relate each block. In principle all block that exist in all area, either black block or white block designed to have kinship four neighbors.

IV. DISCUSSION

To realize self-adaptation ability on a system, the perspective about how the adaptation is understood is needed [6], such as relate to fulfilment of users need, certain character of the system, and environment characteristic [7]. The most concern from this proposed concept is related to users need in easy and efficiency. This is done with construct a control strategy to alternative representation determining as an option of system features that needed when the system is in use, or at run-time. Because according to Chang [3], guarantees adaptation in SAS, compliance needs to be guaranteed at the time the system is running. Thus, we do model alternative configurations through pattern design goal for SAS analysis, this is done to define the behavior of a system or an alternative configuration that will be applied and used when the system is in use or running.

A. Modeling System

A goal is the purpose of the system is to be achieved, the goal can be attributed to the period / time of a system, or a scenario associated with the system [7]. In order to realize the construction of a system to be developed, goal modeling notation we use is the notation Tropos models [8][9]. Based on case illustrations and adaptation automation concept that has been discussed in section II and III, the modeling system can be seen in Fig. 1. The model represents the software control strategies for autonomous in making relationships automatically in the drawing area. As previously discussed, the purpose of "automation relations" is to determine the criteria for a clear assurance and satisfaction level of "ease of use" for the user application. "Automation relation" the goal can be achieved by decomposing into two sub-goals, namely to "the relationship" and "manage the area" work. Sub purpose of performing "relations process" is a representation of the concept of "neighbourhood modeling", and the sub-goal of "managing the area" work is a representation of free space management.

In order to achieve the goal of "the relations" do decomposition again, so it has two derivatives are "handling the request", and "chose the scenario". "Addressing the demand" related to the plan of the system in the "capture

coordinate relations" made by the user when connecting or shifting object relations. While the "select scenario" is an alternative decision taken by the system to "handle the request" is, through two option strategies, namely "left-right relations" or "top-down relationship". "Left-Right Relationships" is selected when the user performs an object relationship that are on the left or right object relationships, while "top-down relationship" selected when users connect objects that are above or below the object relations. Planning of the second option this relation is governed by a mechanism "routing system", in reference to the resource "block list" and "list of relationships" result of the achievement of the goal of "managing the area" work. Planning "routing system" is done to ensure and achieve the level of "accuracy relationship" every object relation in finding a partner.

"Managing the area" done to develop the model structure of the work area into a space relation to each object and determine the relationship when looking for partner relationships. This goal is decomposed into two sub-goals, namely "preparing fragments" area and "set area" free. "Prepare fragment" is set workspace structure as a model, through the planning of "fragmentation" of the area, which is associated with the resources "block list" and "relationship list". While "set area" free space is planned free areas through "calculation capacity", as collateral and the rate "area availability" to achieve the goal of doing "process relationships", which is based on the resource "block list" and "list of relationships".

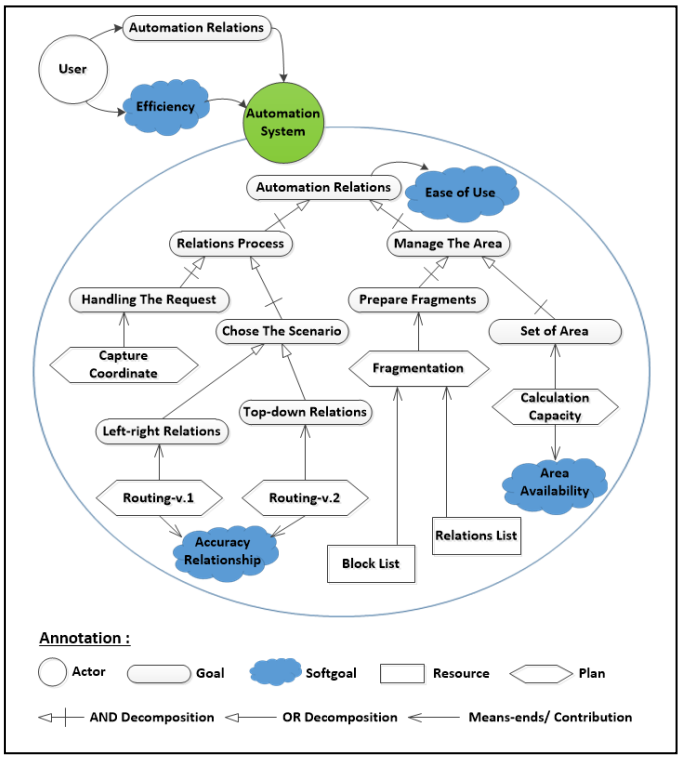

Figure 1. Automatic relation model on spatial relationship.

B. *Area of Structure Model*

Manage the work area as the environment in which the object relation is, prepared by planning "fragmentation" of the area as a whole. Which will be defined blocks that represent the area occupied by the object block area, and a block area that is not occupied by the object, as can be seen in Fig. 2. In the prototype that we have developed, each block is occupied by objects will form the coverage area (the scope) which is bounded by a line on each side of the top and bottom of the object, For example, say there are 4 rectangular objects, namely A0, A1, A2, and A3 which have the scope of its area each as a free area where the object relations will be placed. So from the placement of these objects formed four block area is not free (block occupied rectangle object), and 11 blocks free areas (blocks that are not occupied rectangle object).

At the time of the relationship between objects occur, the scope of each area of the object that is the benchmark where the relationship will adapt. The paths will automatically discover relationships in free area, to achieve the target object, the mechanism of "routing" and to consider the availability of the area from the "capacity calculation" free area. Fragments of each area and the availability of free area is what is the system environment, where the object relation with the automatic ability to be adaptable. In application that has been establish, there is no implement free area management concept. The implementation of management just limited to blocks of area that occupied by every object, so when relation process occured, there is no reference of relation path that should taken on free area.

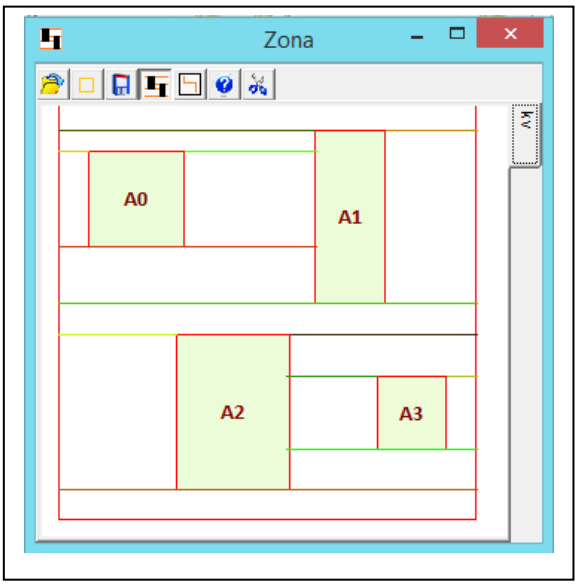

Figure 2. Work area structure model.

C. *Kinship Relation*

The scenario of the mechanism of relations between objects, designed will work automatically. For example, when the user connects the object A0 to A1, A0 to A3, A1 to A3, and A2 to A0, every object relations (line) will adapt browse the free area and choose the object purpose through a nearby line, and without offending or penetrating objects that have been no. While the connector relations will appear dynamically, on the side of a nearby object with the object to be linked.

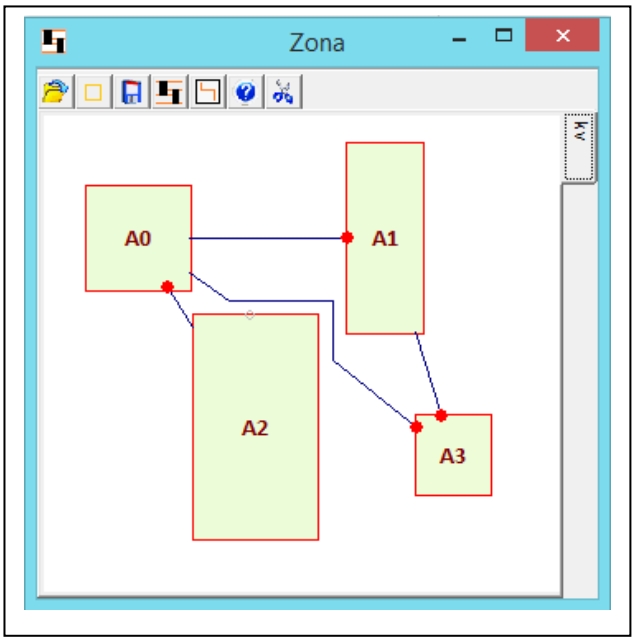

Figure 3. Relation adaptation wuth straight connector.

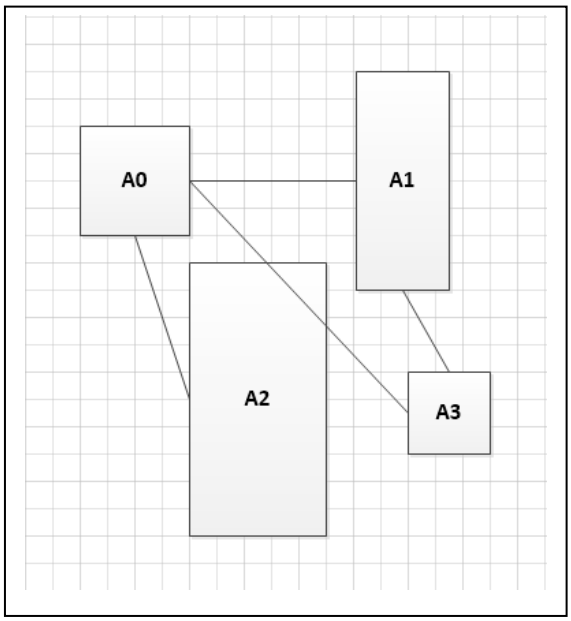

Figure 4. Relation of straight connector with visio.

For example, in Fig. 3 we look at an object connectedness A0 and A1, relation lines connecting the object connected to the middle connector of each object, it is because the position of the two objects is very symmetrical, so the object relations put himself in the middle of the object. However, if we consider the relation lines connecting the object A0 and A3, connector relation objects appear lower right corner of the upper left corner A0 and A3. In addition, the path taken by the object relation is to trace the path of the free area nearby. Likewise mechanisms that occur in the process object connectedness A1 to A3, and A2 to A0. The whole process happens automatically, without having to be reset by the user, in which case the user just simply drag and drop from one object to another object. This is realized by the concept of kinship relationships that have a relation in each direction of the wind, through the selection of routing scenarios carried out by the system autonomously. The example case on Fig. 3 implemented on previous application, so that relation object can penetrate or ride on object that blocking the path of relation, and the linker that connecting between object is not shown up at nearest object side with other object, (in Fig. 4).

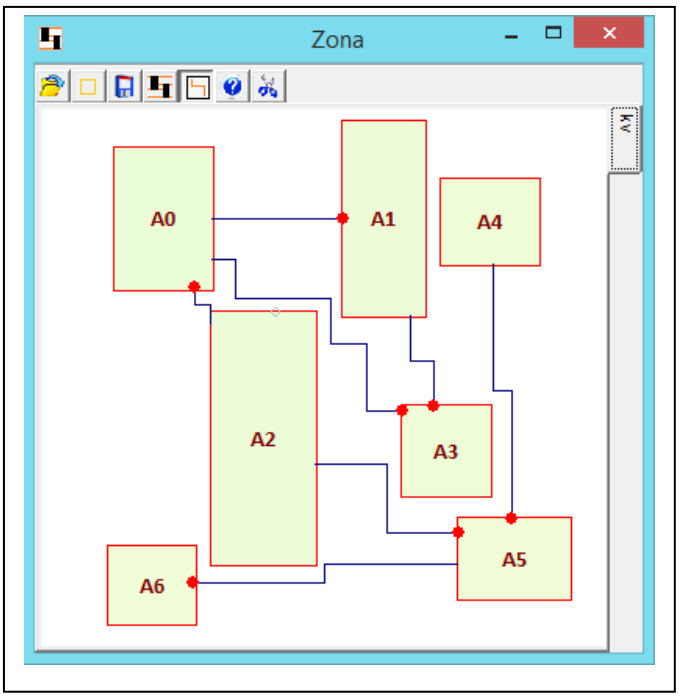

Figure 5. Relation adaptation with right-angle connector.

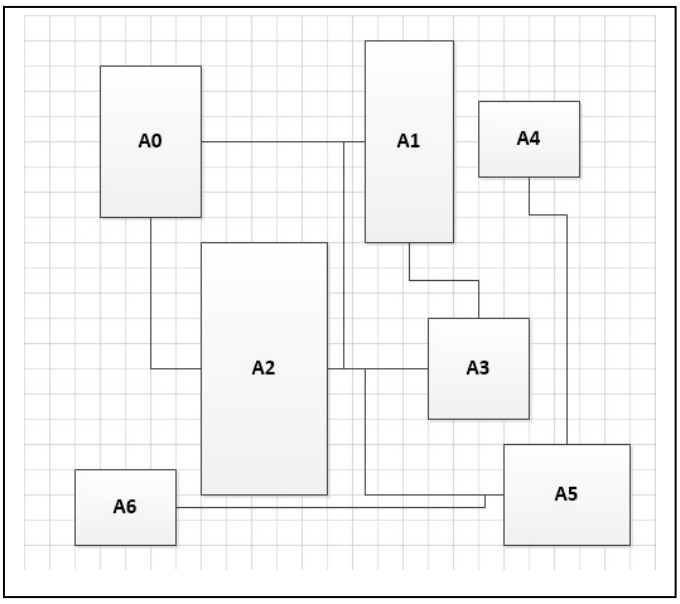

Figure 6. Relation of right-angle with visio.

In addition to provide the view object relation by using straight connector as shown in Fig. 3, the prototype that we

developed also provides a display object relations in the form of right-angle connector as can be seen in Fig. 5. If we compare it with existing applications, such as Microsoft Visio, a connector that connects each object will always be in the center of each object. In addition, the line connecting the relationships between objects still can intersect and penetrate existing objects and also not considering the relations lane closest path that can be taken. So that the view of the relation of each object in Fig. 5 if using Visio application as can be seen in Fig. 6. Perhaps in such applications, they can display a neat relationship lines and did not penetrate the object, but it must be done manually by the user, by resetting the whole related objects.

D. Adaptation Procedure

The model in Figure 1 describes how the system has the capability internally adaptive behavior in relation to automate processes through the neighborhood concept modelling, from beginning to adapt to "handle the request" up to "choose the scenario" that is appropriate for achieving the goal of "accuracy relations". In addition, the system can also act to adapt state of the environment through the concept of free space management, namely with "preparing fragments" of the area and consider the empty space capacity in free "set area" to achieving the goal of "the availability of area" as the working environment of each object relations. This reflects that the system developed has the capability of self-adaptation-related behavioral characteristics of the system of internal adaptation and behavioral adaptation to the environment.

The core process of adaptation automation mechanism of the system. Developed when the system determines alternative representation autonomously, as the decision maker to select proper scenario based on user input. It begins with procedures determining of model goal through system modelling at Fig. 1, so goal model procedure that developed look like at Fig. 7.

```
procedure goal_modelling
decision = decision_on_goal;
case decision :
    - delegate goal to actor
        user actor to automation system;
    - expand goal {gi} in subgoal
        automation relations {g1} ← relations process {g2}
        and managing the area {g3};
        g2 ← handling the request {g2a} and chose the
        scenario {g2b};
        g3 ← preparing fragments {g3a} and set area {g3b};
        g2b ← left-right relations {g2b1} and top-down
        relations {g2b2};
    - contribute g to softgoal {sgi}
        g1 ← ease of use {sg1};
        g2 ← accuracy relationship {sg2};
        g3 ← area availability {sg3};
    - solve associating a plan {pi} to gi
        capture coordinate {p1} ← g2a;
        routing-v.1 {p2} ← g2b1 or routing-v.2 {p3} ← g2b2;
        fragmentation {p4} ← g3a;
        calculation capacity {p5} ← g3b;
```

Figure 7. Procedure goal modelling.

In the other hand, the mechanism of scenario was designed to reach satisfactory g_2 through decision determining g_{2b} is look like as follow:

Scenario-p_2. Left-right relation selected when user moving the relation object to purpose object that exist along the x-axis direction. The searching process will be done with discover the nearest free area when other object blocking moving direction of relation object, then p_3 planning alternative must be done, that is a top-down relation.

Scenario-p_3. The top-down relation selected when user moving the relation object to purpose object that exist along the y-axis direction. Searching process is the same with p_2 scenario that is discovered nearest free area, and when there is another object that blocking direction of relation object, then p_2 planning alternative must be done, that is left-right relation scenario.

V. CONCLUSIONS

The approach that developed in this paper is using working area that constructed as a guide to relation moving in determine purpose target option. The result is, it's can arrange chain of graphic object unity with the layout and relation harmony automatically. This matter very easy and too fast user in their job, because a user should not busy with resetting of the objects when adding or changing position, even with a considerable amount of object and it's relation complexity. The result is the main contribution form proposed approach, where self-adaptive system (SAS) has succeed implemented to fullfill requirement of graphic elements regulation as complement from previous application drawback.

The concept that underlie system performance consist of two approaches, namely free space management, where availability of free area ruled as model structure for relation moving path selection, and neighbourhood modelling is a candidate relation with provide connector that dynamically could make a link through path on free area that available. Both those mechanisms realize a self-adaptation system ability, where free space management represent external adaptation behaviour that connected with system working area availability and neighbourhood modeling represent internal adaptation behaviour in relation process automation.

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CERTIFICATE OF CONTRIBUTIONS

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ENTITLED

AUTOMATICALLY RELATION MODELING ON SPATIAL RELATIONSHIP AS SELF-ADAPTATION ABILITY

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