



6th International Conference on Smart Computing and Communications, ICSCC 2017, 7-8  
December 2017, Kurukshetra, India

# Dynamic Reconfiguration of robot software component in real time distributed system using clustering techniques

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## Abstract

The requirement of the distributed system in optimum resource is creating the new scope of business for the software industry in the area of component based technology with data mining techniques. In optimization of software, the development cost, redesign complexity, resource planning has been growing area of search based software engineering. The reuse of artifacts has been growing over the last decade and the recent works have focus on dynamic reconfiguration of logical component design. However, there are still gaps for identification and reconfigurations of software service component. In this paper, the proposed algorithm gives effective approach for dynamically reconfigurable of the design in real time application with new software service component using clustering techniques. This algorithm is able to handle the large system data set and also applicable for the multiple hierarchy redesign problem. The proposed algorithm compared against similarity score algorithm using a case study of robot path planner class diagram.

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Peer-review under responsibility of the scientific committee of the 6th International Conference on Smart Computing and Communications

**Keywords:** Distributed System, Software Component, Clustering, Similarity Score Algorithm

## 1. Introduction

To identify a relevant software component from the software component set is a challenging task and it has been mentioned as NP complete problem [1]. According to Birkmeier and Overhage three categories of components are business oriented components, architectural or logical component and the technical components [2]. Usually the reuse of software service component and component based development is not in practice of robot application [3]. It seems to be an demanding area in the robotic software service field [4]. During the development life cycle of robot software, a software designer is responsible to decompose a system using relevant software components. However, because of lack

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of perfection it is an extremely difficult and error prone task to identify and decompose logical component without any supporting tool[2]. To overcome this difficulty, several methods have been suggested to identify taxonomic position of vulnerability or software defect density or logical component[5, 6, 7, 8, 9]. In current scenario developers are trying to find the suitable software component for the existing system in a specified design patterns.

According to the Christopher Alexander et.al, a unique pattern can be used in the design of object oriented software component[10] It also helps to developer to choose alternative that make a system reusable and avoid that compromise reusability.

This paper concentrates on dynamic reconfiguration of robot software service using reuse software service component using clustering techniques. A component is representing the prerequisite information on software services can often be obtained directly from the software requirements phase [11]. The class diagram of robot software service and Gamma et.al.[12]. The class diagram represent the static structure, the attributes operations and the relationship between the classes. Class diagram of robot software service is partitioned into the subsystem having at least one generalization or specialization relation in between the classes. This subsystem class diagram is the first input for the proposed algorithm and for second input we take the catalog of design pattern [12]. For a large system, Tsantalis et.al. handle the issues of multiple inheritance in system but not applicable for the robot software service component.

The proposed algorithm also dealt with the problem of reuse entity for defined requirement on the basis of similarity coefficient using clustering techniques[13]. The algorithm uses centroid which has been decided by the similarity between the subsystem and design patterns and also valid for the outlier. The component identification problem is based on feature based similarity of the search space but features are not clear, e.g. analysis classes. It is not easy task to define features of analysis classes in a multidimensional space. The proposed algorithm also has self organized capability to organize the number of components upto the matched design pattern features. It also dealt the problem of feature based multidimensional space having some noise in data. For analysis of proposed algorithm the theoretical comparison is shown using a case study of Robot path planner class diagram.

The rest section of this paper is arranged as, Section 2 presents problem formulation. Related work is shown in Section 3. Mathematical background of algorithm is presented in section 4. Section 5: Describe the steps of proposed algorithm. Result analysis and conclusion has been shown in section 6 and 7.

## 2. Problem Formulation

In Rational Unified Process (RUP) several problem models is defined for the representation of requirement of a common problem [14] According to the recommendation of RUP methodology, the analysis class diagram consist the description of the all three classes: boundary (interface), control and entity class. In Fig 1. User describes the objective in form of a story about the requirement. First step of the proposed method is the prepare a class diagram according to the objective by Visual Paradigm Tool 12.1. and then identify the subsystem of class hierarchies. After collection of class diagram of system and types design pattern, prepare a cluster that defines the second problem. In third step, the reconfigure the logic view of the system is performed on the basis of clustering of design pattern and subsystem. The logical view structure of the system has the self organized capability to update with the component structure if any optimum possible partitioning threshold is achieved. The goal of this paper is as follows:

- To partition the multiple hierarchies (Generalization relationship between the classes) of the software service using the cluster of design pattern
- To identify the cluster of similar type of subsystem and design pattern of robot software services logical components, used as a reuse entity for defined requirements on the basis of Pearson & Heron-II similarity coefficient.
- Systems having dynamic reconfigurable capability to rearrange the logical view of the robot software service according to the design pattern cluster.

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