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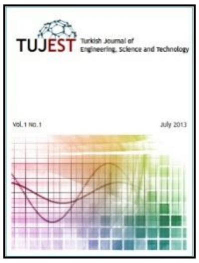

Development of the E-Commerce Dialogues using Dynamic Context-aware Web Services Composition

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Abstract

Nowadays, e-commerce tries to expand its audience and improve the quality of services provided to end-users. There are two significant issues that should be considered to achieve these goals. First, studying the needs of mobile users growing with the development of communication technologies and, second, including features for providing context-aware services to enhance the performance of dialogue between users and systems. Dynamic composition of web services with context awareness is the approach that covers both issues. In this paper, by integrating an agent-based system with other models of dynamic web service composition, an abstract agent-based model capable of combining and adapting context-aware services coupled with quality service, has been proposed. In this model, the agent is used to minimize user intervention and completely automate service composition and the context processor is used in each service and agent, for context-aware adaptation and context-aware composition, respectively. Using the QoS component in agent section, the quality of service is controlled. Compared to other similar models, the advantages of proposed methods are controlling quality of service, considering dynamic of user context, utilizing both services composition and adaptation simultaneously.

1. Introduction

For The goal of this article is to presents an abstract model based on context-aware web services dynamic composition for e-commerce applications. Web service is a modular, self-describing, adaptive application based on distributed environment [1]. Although, the function of a single web service is limited but due to the interoperability and reusability of web services, they can be composited to perform more complex tasks [1-3]. Interoperability feature leads to develop complex systems by integrating diverse applications, independent of platform and running place [4, 5]. Creating process of services chain as a composition plan and executing this plan to satisfy user complex requirements named as service composition [2, 3, and 6]. Service composition process based on service selection time for composition plan is categorized to static and dynamic groups [5,7 and 8] that in dynamic composition, composition is executed at user request time (run time) [3, 7 and 8]. In e-commerce with the development of pervasive computing environments for supporting user tasks and frequent changes in their requirements and also faced challenges of dynamic environments like heterogeneity, mobility and resources constraints, using dynamic service composition method that is able to deal with environment changes is useful [9]. On the other hand, user needs are changing simultaneously. Users want desired information from vast data regardless of time and place. As a result, use of context that can be used in describing conditions of an entity in service composition, is an

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acceptable and satisfactory method [10-14]. One of the challenges of dynamic composition of web services is wide variety in context sources and great dynamism of these resources [11] that existing models use just fixed and predefined context types. Another challenge is frequent changes in end users requirements and requests [9] which despite variant dynamic composition models dealing with this issue, but still problems such as real-time reaction to changes in these models exist. Presenting a high quality service that mostly matches with user need [10], is the next challenge that existing models for facing this challenge, utilize the service context-aware composition or service adaptation, but both is not simultaneously provided and the service quality control has not been considered [8, 10-12], finally the last challenge is the web service dynamic composition with the least user interaction and automatically that is just responded well in the agent based models [15]. In the presenting model in this article is tried to present a agent based model with the ability of context-aware services composition and adaptation simultaneously and providing services quality control by integrating agent-based systems with other models of dynamic web services composition.

The rest of the article is organized as follows: section 2 provides the related works in web services composition for e-commerce. Section 3 shows the basic structure of a novel model. Then in section 4 a case study of the model is presented. In the section 5 this model is evaluated and compared to other models. Finally, section 6 is a conclusion.

2. Related Work

There Nowadays, dynamic web service composition play a significant role in service oriented systems that among them the e-commerce applications as having a variety of Web services over the internet and the daily increasing audience of such systems with frequent changes in their requirements and need of offering a composition service in a real-time manner and at the time of service demand, allocate a greater proportion of researches in this field [10-12]. There are several models in the field of dynamic web services of e-commerce that each of them deal with this issue from an individual view and with specific aim. In this section overview several of these models.

Context-aware web service composition model for e-commerce applications named ECModel [10], is based on a formal model, Context-aware Process Network (CAPN), which is a dataflow and channel based model of cooperative computation. The aim of this model is effective process and to take advantage of contexts and to facilitate the development of context-aware E-commerce applications. In this model, context-aware is provided by contributing context-aware adaptable web services in composition. In fact, web services involved in composition use user contexts (that they are fixed and predefined) for their adaptation with user need by using a context processor. As a result, this model challenge is that does not use context-aware for web services composition. Also, services use only predefined and fixed user context types for adaptation. There is not Ability of service quality control in this model.

Also, Dynamic web service composition can be implemented by using agent-base systems [15]. In fact, service composition can be performed dynamically and without any predefined and abstract plan by using agent contribution. In addition, agent-base systems provide distributed features and improve scalability. But, this model just take advantage of agent-base systems which the most important of them is less user intervention in interaction and automatic composition. There is not Context-aware in this model. Also, service quality is not controlled.

CCML Model [11] or Cooperative composition modeling language is a web service composition description language which is able to describe the service information and the interaction among the services. Context-aware is basic feature of CCML. In CCML, context information is embedded in the description of service in CCML. As the result, CCML is able to support context-aware. Also, in this model, context-aware is used for web service adaptation with user need and is not used explicitly in service composition. In this model, user context types is unlimited, but fixed and predefined, by the way that effective context types in each services provide in the its context part of the CCML structure, moreover, QoS control does not exist in this model.

Context-Aware Service Enabling (CASE) model [12, 16] combines context-aware service discovery with service composition for enabling the development of adaptive context-aware applications. The main function of the CASE platform is to adapt services (including context sources) dynamically by changing their composition in response to context changes, while these services are being used. To accomplish this, the platform consists of a composition service and two types of discovery services: a context-aware discovery service and a basic discovery service. In this model, service composition is context-aware, but context-aware service adaptation is not performed to offer more accurate and closer service to user need. Also, QoS is not controlled in this model.

In [17], a model named FUSION is presented which divide service composition process into six subsystems. These six subsystems are (1) User Specification Subsystem (USS), (2) Web Services Dynamic Plan Generator Subsystem (WGS), (3) Plan Execution Subsystem (PES), (4) Verification Subsystem (VS), (5) Recovery Subsystem (RS), and (6) User Response

Generation Subsystem (URGS). This model is not user context- aware and evaluates and verifies service quality based on user specified satisfaction criteria.

In [18], an architecture is presented for building context aware applications as dynamically composed sequences of granularity Web services calls. Different service compositions will result from different contexts such as: devices available, bandwidth, time constraints, location, user requirements and profile. In this article, a context aware dynamic service composition model is presented by using the SHOP2 planning system and the BPEL4WS Web service composition technology. Also, this model just is context-aware composition and there is not ability of context-aware service adaptation. QoS is not controlled in this model.

Article [19] presents a model for semi automatically composing Web Services into Web Processes by using their ontological descriptions and relationships to other services. In Interface-Matching Automatic composition Technique, the possible compositions are obtained by checking semantic similarities between interfaces of individual services. Then these compositions are ranked considering their Quality of Services (QoS) and an optimum composition is selected by assisting human from a ranked list at certain stages. Model involves three components: composer component, ontology and service storage component and extraction component. In this model, composition is semi-Automatic and needs to user assistance. Also, there is not context-aware in service composition and adaptation, user priority can be recognized through user profile and services can be ranked based on user profile. Service quality control is not provided.

In [20], an e-commerce service composition model named EC-SCP is presented for supporting pervasive e-commerce. Model consists of an Orchestration Component and several Atomic Service Components. The model is based on atomic reusable and sharable service components. It employs efficient P2P interaction between two components. Also, in this model, QoS is guaranteed by the runtime QoS monitoring and dynamic adjusted two-dimension orchestration plan. In this model, there is not context-aware, but, user priority is used for customizing composite service through user profile. In fact, none of the composition and adaptation does not perform with context-aware.

Article [21] proposes the broker based model for dynamic Web service composition. The broker plays a major role in effective and efficient discovery of Web services for the individual tasks of the complex needs. The effective Web service discovery and composition Mechanism is based on functional semantics and operations flow semantics. This model involves five roles: Service provider, Service requester, Service composer (generic service provider), Service registry and the Broker. Additional to these roles, in this model, operations are defined for relation between these roles. This model like agent based model is not context-aware. But, composition is performed automatically by using broker. Also, there is not the ability of the service quality control in this model.

Finally, in [22] is presented an event based context-aware service discovery and composition model. This model is formed of two solutions, SECE and GloServ. SECE platform is user-centric context-aware platform for service composition which provides natural English-like formal language for creating event based rules. GloServ is a scalable network for web service discovery. This model performs service composition with user context, but there is not service adaptation for obtaining more accurate result. Also this model does not consider quality of composite service. In this model, however, user uses English-like language for interaction with system, but this interaction is not based on natural language and independent of user unlike intelligent agent based systems

In table 1, an overview of disadvantages of this models are expressed.

Table 1. Comparison of the disadvantages of existing models

Disadvantages	**Models**	**Troubleshooting By Suggested Model**
None context-aware	Agent-base system [15] ،EC-SCP[20] ،ontology driven model [19] ،broker based model [21] ،FUSION[17]	Using of context-aware
Predefined and fixed context types	ECModel[10] ،Agent-base system [15] ،CCML[11] ، CASE[12] ،EC-SCP[20] ،ontology driven model[19] ، broker based model[21] ،FUSION[17] ،SECE[22] ، planning based model [18]	Dynamism in using context type to offer more user oriented and accurate service
None context-aware service adaptation	Agent-base system [15] ،CASE[12] ،EC-SCP[20] ، ontology driven model [19] ،broker based model [21] ، FUSION[17] ،SECE[22] ،planning based model [18]	Using of service composition and adaptation simultaneously to offer

		better and more accurate service
None context-aware service composition	ECModel[10] ،Agent-base system [15] ،CCML[11] ،EC-SCP[20] ،ontology driven model [19] ،broker based model [21] ،FUSION[17] ،SECE[22]	Using of service composition and adaptation simultaneously to offer better and more accurate service
None QoS control	ECModel[10] ،Agent-base system [15] ،CCML[11] ، CASE[12] ،ontology driven model [19] ،broker based model [21] ،SECE[22] ،planning based model [18]	Using service quality service
Not using of intelligent agent in model	ECModel[10] ،CCML[11] ،CASE[12] ،EC-SCP[20] ، ontology driven model [19] ،broker based model [21] ، FUSION[17] ،SECE[22] ،planning based model [18]	Using of intelligence agent to maximize automation and minimize user interaction

3. Proposed model

In this section, an abstract model is presented for the context-aware dynamic composition with the goal of solving the problems of previous models. In this model by using agent for interaction with user is tried to make the user intervention minimum, and the automating dynamic web service composition maximum. In fact, user give his/her request in a natural language to agent and the agent return a result, also can make both service composition and adaptation processes, context-aware by using context processor in each of services and agent for service composition. Using search engine and tree context resource, sensors, ontology repository and existing database in context management provides the ability of context-aware dynamically and on demand and not fixed and predefined. The general architecture of the model is shown in Figure 1 and the variant parts of model 1 will be described in the following. In the figure, solid lines, are shown relations between different model parts and dotted lines to show relations details, display the internal components relations with other parts components.

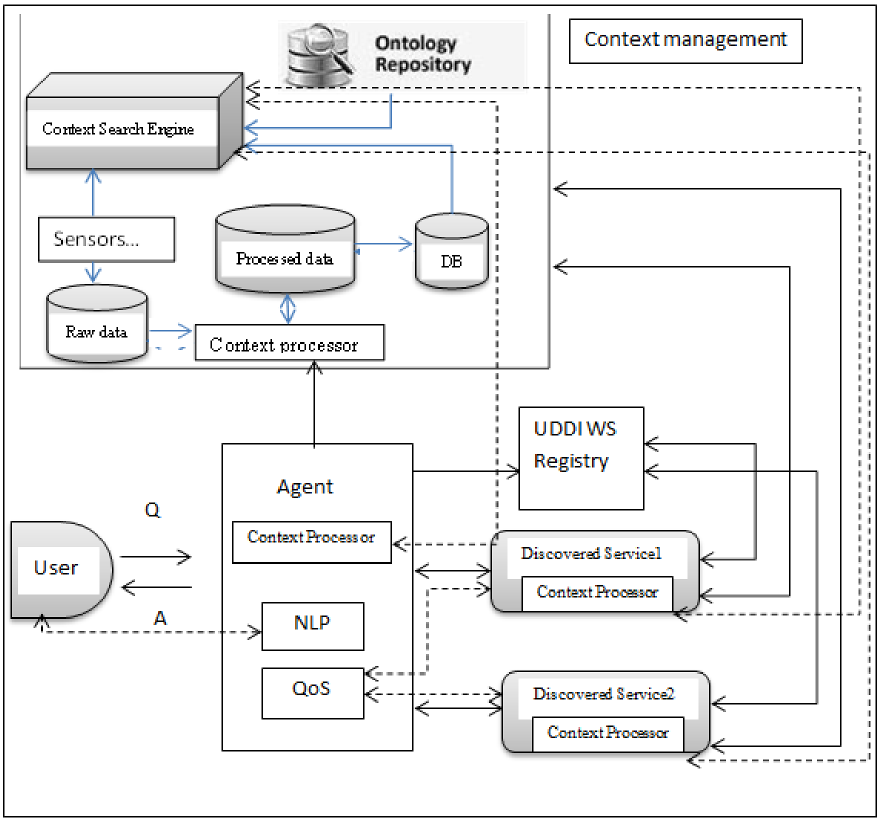

Figure 1. The architecture of the proposed model

- Agent: in this model, user gives her/his request in natural language to the agent. Agent processes the request by natural language processor and by using its context processor, requests related context types from context management to provide a better service in a XML file format. Agent in this model provides the ability of minimizing user interactions and automating the composition. Dynamic web services composition with context-aware is provided by using context processor of agent. The quality control in compositing services is performed in QoS component of the agent. QoS examine quality of the relationship between service and customers [23]. Qos characteristics in web services should respect the agreement between service provider and the users [23]. Criteria of selection and composition of services is on the basis of QoS to deal with issues such as throughput capacity, latency, response time, availability, reliability, reputation and execution cost[24].

- Context management: Context management means providing of required contexts types from various resources and processing them to offer the exact composite service with low-latency in scalable, distributed and dynamic environment [11]. context management provides related context with any types from three major resource, ontology repository, database and sensors by using search context search engine and modifies sent XML file and resend to agent, in other words it can be said required context types determine by using this engine and dislike previous models it's not required to predefine these types and for instance save in an XML file. Also in this model, the problem of fixed and predefined context types from other models can be solved by using context management part (context search engine and tree context resource). In fact, variant user context types can be searched as requested by search engine of the context management model section and for offering better service to user.

- Web services composition: After receiving file, according to the user context, the agent modifies the request and searches the related services in the UDDI WS Registry, to select the most matched services with user request and context. Then it evaluates the candidate services by QoS, select the services with the best quality and composites.

- Web services adaptation: Adaptability means improving behavior or the result of a service in special conditions by the service itself, based on the awareness of the user context [10, 11]. During composition and executing services, each of them tries to match itself more with the user request based on the context. In fact, services have awareness of the context and at same time become matched by context processor. Finally a composite service is offered with highest quality and closest to user need. In fact, services become adaptive by using context processor in each service.

After describing model's components, it is required to discuss the relations between existing model's components. In this model as shown in the picture, user has two-way communication with agent by natural language. The agent and contributed services have two-way communication with context management search engine by their context processor. On the other hand, agent searches the related services by WS Registry, then selected services in the agent QoS section are evaluated and more suitable services contribute in composition. In context management section, search engine after receiving the related context request of agent or contributed services in composition searches the required contexts in three context resource and returns the result to context requesting. Also existing context processor in context management part processes the received row data from sensors and preprocessed data and saves in processed data part. More used data saved in database for future use.

4. Case Study

In this section, food ordering system is discussed as study case. In this system, user gives her/his food order to system agent in natural language and agent delivers composite service according to required user context. Sample scenario is described for this system as follows:

I. A user gives food order to provider system As follows:

II. "I want a food with the Cheap Price and good quality of food in the possible fastest time"

III. Agent processes this order by using natural language processor and to find out the meaning of the Cheap price and quality of food according to the user request, it concludes that must find the user location, user obesity or wasting, order time, financial user situation considering its location and her/his food taste; so it search these contexts by using its context processor through the context management.

```
<? xml version="1.0" encoding="UTF-8"?>
<ccml:context>
<ccml:contextType name=" location " dataType="String"/>
<ccml:contextType name=" Weight " dataType=" String "/>
< ccml:contextType name=" Financial position" dataType="String"/>
< ccml:contextType name=" Tastes" dataType="String"/>
< ccml:contextType name=" Time" dataType="time"/>
</ccml:context>
…
</ccml
```

IV. First, Context management uses its search Engine to find user location and weight by sensors. Then, user taste is found by checking user work history on the internet that is saved in ontology repository. Order time is considered order registration time and User financial situation is obtained by processing raw data like user location that is founded by sensors and user Purchase history is obtained through ontology repository, by using exist context processor in context management part. By the way all these information is searched in database first and if they‘re not found, the mentioned resources is used.

V. Finally, context management give whole of these collected information to agent, for example a user lives in north of Iran, in sari city and its exact address is … and his/her financial situation is medium and he/she is vegetarian, ordered a dish for dinner and her/his weigh is 50kg.

```
<? Xml version="1.0" encoding="UTF-8"?>
<ccml:context>
<ccml:contextType name=" location "value=" ………, Sari, North of Iran" dataType="String"/>
<ccml:contextType name="Weight " value=" 50 Kg " dataType=" String "/>
<ccml:contextType name=" Financialposition" value=" medium " dataType="String"/>
<ccml:contextType name=" Tastes" value=" vegeterian " dataType="String"/>
<ccml:contextType name="Time"value=" 8:30 pm " dataType="time"/>
</ccml:context>
…
</ccml>
```

VI. Agent searches related services by this information and selects services which are closest to user need, have reasonable price, is made of vegetables and is ready now. Then evaluates selected services by QoS and selects services with more quality that have related conditions and composites them. In this situation, Composition is used to provide food from a service and delivery from another service.

VII. During composition and services execution, each of the selected services processes user context by using their context processor and adapts themselves with it. In this example, food offering service considers user financial situation and uses its special discounts to provide service. Or considers user food taste and provides more salty or greasy foods.

VIII. Finally, composite service is offered to user. Highest quality food is found that is closest to user needs considering his/her price, preferences and weight and the food is ordered.

5. Evaluation

For evaluating suggested method, it is compared with other models based on existing parameters in table 2. Existing parameters in table 2 for evaluating and comparing models, are the features provided to face existing challenges in dynamic web services composition in e-commerce plans.

Actually, as mention in the paper, there are challenges to develop such services that each of the discussed models in this paper, considers a part of challenges. In table 2, these features in various models, are evaluated and compared.

Table2. Existing models for the dynamic composition of Web services in E-commerce

Models	Supporting of QoS	Context-aware	Unlimited and dynamic context types	Context-aware service composition	Context-aware service adaptation
ECModel[10]	NO	YES	NO	NO	YES
Agent-based system[15]	NO	NO	NO	NO	NO
CCML[11]	NO	YES	NO	NO	YES
CASE[12]	NO	YES	NO	YES	NO
EC-SCP[20]	YES	NO	NO	NO	NO
Ontology driven model[19]	NO	NO	NO	NO	NO
Broker based model[21]	NO	NO	NO	NO	NO
FUSION[17]	YES	NO	NO	NO	NO
SECE[22]	NO	YES	NO	YES	NO
Planning based model[18]	NO	YES	NO	YES	NO
Suggested model	YES	YES	YES	YES	YES

6. Conclusion

To overcome the challenges in e-commerce dialogues, one of the approaches most appropriate approaches is context-aware dynamic web service composition. In this paper an abstract model of context-aware dynamic web service composition for e-commerce dialogues is developed. In The suggested model has been tried to reduce the perception and cognition load by involving less user interaction and the gap between the user and the system is reduced by using the user's natural language processor. Also presented model is user centric by taking into account the user's context. The dynamism of the model is provided by applying the dynamism in service composition and adaptation and in the use of context-aware. In the future, we will develop the proposed model as an implementable Model for context-aware dynamic composition of web services and provide a prototype for evaluating this model.

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