A Survey for Context – Awareness Based Issues in Pervasive Computing

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Abstract – A pervasive computing describes that any users can communicate with any systems in anywhere. In this environment people can interact with embedded computers mostly those are invisible and in which networked devices are awareness of the atmosphere as well as peers.

Meanwhile they are able to provide services or use the Services from peers effectively. Context awareness is an important property in pervasive computing which can sense their physical environment and adapt their character accordingly. Now-a-days there are more issues and challenges arising in context awareness. Issues are such as context accuracy, reliability, conflict situation, unexpected adaptation, power management, and security and privacy. To avoid these issues in this survey, different techniques and solutions are recommended and examined. Context prediction method is used to recognize not only the current context but also can predict the future context. However it can handled centralized architecture alone, not yet implement in the decentralized system.

Conflict Resolving Policies is used to handle the conflict situation. This is useful for improving the performance of context awareness. And Internet of Things middleware is addressed the scalability, incomplete data and conflict resolution. To avoid those entire scalability, conflict and complexity problem we are in need of efficient intelligence system. Due to large complex data and long computing time the energy issue is arised in context aware.

Authentication of user location and information should maintain throughout the process. Hence at last we discussed the issue of security and privacy. The following work analyzes the various issues and challenges and provides sufficient solutions to overcome with it.

Index Terms: Context – Awareness, Pervasive Computing, and Issues.

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INTRODUCTION

The pervasive computing is also known as ubiquitous systems which are mainly focused on the context awareness techniques. In fact, the pervasive information devices are distinguished by various data and the interrogation of these systems are passed out at anytime, anywhere and by any type of devices. Pervasive computing devices are mainly depends on the NNN paradigm (aNywhere, aNytime, with aNything) [1]. Most characterizing from conventional computers will be the capability of a digital artifact to communicate to their physical location. Usually computers have been detached from the circumstances, in which they are used, and only recently location and context-awareness has established improved interest. In pervasive computing the location and context are considered as a keywords.

The interaction between system-human and systemmultiple system was increased a lot. The latest internet technologies drive a more general interest in contextawareness such as smart phone applications (Google maps, Gmail and yahoo mail). Context-aware applications and services nee`d equipment from the foundation of wireless network, user infrastructure, and middleware. Furthermore, application and technology associated with network, middleware and user communications are based on concept and research activities.

In pervasive computing the context aware is an important aspect. Context awareness is belongings to mobile computing or cloud computing. This is used to complementarily for location awareness. While location is determining that how certain process operates in a system, context might be added for more flexible to mobile users (eg. smart phones). Context aware devices may also try to build guess about the user's current situation. Context is any information which can be used to represent the location of an entity. But the context awareness is affected by some factors in terms of prediction,

communication overhead, comprehensive context and unauthorized user access. The major issues addressed in the project we report are the **Context Modeling, recognition, reasoning, Quality of Contexts (QoC), unexpected adaptations, Power management, Security and privacy.** Context prediction allows a system to turn into truly proactive. For industrial applications, this can involve actual economic cost.

Sometimes, in pervasive computing the context aware systems have to manage conflicting situations while collecting data and extracting high level context data information. Hence to reduce this problem, use quality of context parameters [2]. Context aware systems are computer devices that can makes available the relevant services and information to customers by developing context. However everyone needs to protect their personal information. People don't like to disclose outside who they are and what services they want [3]. Smart phones become as a pervasive computing application, their power consumption remains one of the major prominent issues.

In the following survey, there are different type of techniques are recommended and the issues, challenges and performance are analyzed. Web ontology language approach such as Context Broker Architecture (CoBrA) is better for handling the context modeling and reasoning.

Context based prediction method is recommended for power reduction. To maintain the privacy and security of sensitive context data introduce few authentication policies such as Gaia Authentication, Mist – Privacy Communication, Dynamic Security Policies and Access Control.

2. TECHNIQUES USED FOR HANDLING THE ISSUES OF CONTEXT AWARENWSS

There are different types of technologies suggested for handling the context-awareness issues and met few solutions to avoid those problems. In this literature survey few methods and policies are considered how they tackle the problem and decrease the issues in pervasive computing.

Context modeling, reasoning and recognition

Context modeling is described as an enclosing environment of some devices and context is surrounding element for the devices [4]. Context modeling is following an ontology based approaches. Context recognition is identifying the situation of user. This includes what and how the situations are recognized from the context. And reasoning is managing the uncertainty situations. Ontology web language is used to provide semantic based context for particular users.

1. Comprehensive context modeling framework

Context modeling framework is focused to provide clarity in information and representation, meaning and usage. It takes into description the common behavior of context information such as its temporal nature, uncertainty, impreciseness, incompleteness and privacy. Also context model should address special requirements of pervasive computing environments like distribution, mobility, heterogeneity of context devices. Hence, have to improve the support for automatic context reasoning. Some of the existing approach of context modeling is Key-Value Models, Markup Scheme Models, Graphical Models, Object Oriented Models, Logic Based and Ontology Based Models. All above approaches are based on the ontology concept (CoBrA). This system makes available a set of ontological idea to describe entities such as people, places or several other kinds of substance within their contexts.

The CoBrA method uses broker-centric agent architecture to provide runtime support for context-aware systems, particularly in Intelligent Meeting Rooms, a prevalent scenario of a pervasive computing environment. However these methods are not applicable for heterogeneous pervasive computing environment. To overcome this problem used MUSIC model which contains three layers are conceptual, exchange and functional layer. Model Driven Development is used in conceptual layer which is used to enable the description of context such as objects, scope and illustration. Also it is depends on the standard specification language like UML and OWL (Web Ontology Language) [5]. The method makes easy the context reasoning by given that structure for contexts, rules and their semantics. In context management system using context data or element, the semantic concept have to illustrate. Context awareness performs reasoning about the context and passes decisions about the actions to be triggered. Ontology based approaches are used to support the context reasoning efficiently [6][7]. The goal of exchange layer is to be utilized for interoperability between computing systems. In this layer the context information is represented as a sufficient depiction like XML. Functional layer is used for actual implementation of context model demonstration and the interior mechanism which will be used for various modes. With the concept of ontology based approach, to establish a common vocabulary of concepts and to explicitly address heterogeneous representations of context information in pervasive computing. However it makes a serious problem with devices in case of limited sources and arising a problem from plugging mechanism.

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2. Context recognition

Based on the context recognition we can avoid critical based situation in pervasive computing. Recognize and predict high level context information from low level sensor data is presented. Using a distributed context-aware system with context prediction, we can generate a finegrained dynamic prediction of power consumption, thus improving the accuracy of approximation, and reducing loss through faster, automated reaction [6][8]. However this is failed in case of decentralized architecture. Also context prediction provides mostly informal description of the problem. Also these methods can not able to handle the conflict situation.

Conflict situation

In pervasive computing and mobile devices context aware systems are facing lot more conflicting situations during the collection and extraction of high level context information.

Quality of context is useful to give solution for uncertain and conflicting situations involving context information.

Quality of context parameters is helping to face with these issues. Why this issue arise means, first have to collect raw data then from this data have to extract high level context information. After removing repeated and inconsistent context have to combine and save the context information and finally delivering this context data to specific users.

Several conflict situations are occurring due to execution of above tasks. These conflicting conditions powerfully influence the potential of context-aware systems to adapt to the evolving situation in pervasive environments **[**9**].** Even few existing methods were available to resolve with the conflict situations. But those strategies might slow down the process of decision making, divert user, or remove few significant context objects as well [10]. Hence to avoid this drawback new method Quality of Context parameters introduced. It is described as up-to-datedness, trustworthiness, completeness, and significance, are used to specify the quality of context information. So in this method have to analyze conflict situation of context aware system and propose the solving policies depends on QoC parameters. Up-to-datedness pointing the degree of rationalism to exploit a context objects at a specific instance of time. This metric can be helpful in determining the conflict in the context object that alters its value very speedily, e.g., location of a fast moving vehicle.

Trustworthiness is the amount of the appropriateness of a sensor to collect the context of a particular type. We have to compute the trustworthiness of a context object on the concept of space resolution and accuracy of sensor to measure that type of information. This concept is particularly useful in resolving the conflict when we have more than one sensor collecting the context of same entity or event. Completeness of a context object is mostly essential to get the comprehensive picture of the present circumstances of real world. According to this policy decision is made on the basis of that context object which has more complete information about current situation.

Significance measures the worth or preciousness of context object. It is particularly important to mention this metric when there is a context object of high critical value. Based on the threshold value, users conflict situation handled by the QoC parameters [11] [12]. However this method also failed to handle the unexpected adoptions in pervasive computing.

Unexpected adaptation

Due to unsolved problems, sometimes unexpected situation occurred in pervasive computing. The most challenging issues are managing the loads of users and things, provided that interoperability across the heterogeneous things, and overcoming the unknown dynamic environment due to the mobility of things. Service-Oriented Architecture (SOA) is used to face the problem of unexpected situation. If there is a huge number of a request then complicated coordination occurred among millions of Things and services [13]. In such situation, performing even a simple service detection or composition may go beyond acceptable time, communication costs and resource consumption. To conquer the above challenges, we revisit the SOA itself along with the functionalities of traditional service-oriented middleware. Specifically, we present a Thing-based SOA that relieves service consumers from heavy communications and computations. All tasks in SOA revolve around a business logic that can be satisfied by one or several services. Thing-based SOA and a middleware designed to address the large scale, heterogeneity and unknown environment issues of the mobile IoT. However privacy concept is still missing in this method.

Security and Privacy

The main issue is dealing with security and privacy factor. Hence we have to improve the security mechanism of context sensing in pervasive computing. To deal with this issues introduce the terms Gaia Authentication, Mist – Privacy Communication, Dynamic Security Policies and Access Control.

Authentication mechanisms in pervasive computing environments should strike a balance between

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authentication strength and non-intrusiveness. This allows the authentication process to enable principals to authenticate themselves to the system using a variety of means. These include the use of wearable devices, face recognition, smart badges, fingerprint identification, retinal scans, etc. The logic used includes temporal and fuzzy operators that allow the policies to capture context or temporal information, like revocation of authentication credentials under certain circumstances and so on. Because of the various authentication methods and their different strengths, it is sensible to accommodate different levels of confidence and incorporate context [3].

Dynamic security policy contains program modules correspond to the dynamic policy implementation, and can be enforced by executing them in a suitable software context. Security concerns need to be integrated into models of system behavior, and security policies have to form an integral part of system specifications. This research is crucial in the context of active spaces and in other dynamic environments where operational parameters are constantly changing.

Dynamic policies enable the creation of customizable programs that can be deployed on-the-fly, to enforce and implement strong security policies that can adapt to a changing software environment. Another mechanism is **mist privacy communication** which allows certified individual to access services while protecting their location privacy. The following is overview of how Mist works.

Mist contains a privacy preserving hierarchy of Mist Routers that figure an overlay network. This network makes easy confidential communication through routing packets via hop-by-hop and handle-based routing protocol.

We use public key cryptography in the initial setup of these handles. These methods formulate message impossible to map out by snoopers and untrusted third parties. A handle based protocol is an identifier which is distinctive for single Mist Router. "Incoming handle" is contained by every received packet which is utilized by the Mist Router to recognize the subsequent hop to which to ahead the packet.

The arriving handle is exchanged by an outgoing handle earlier than the packet is broadcast to the following hop. And hop-by-hop routing protocol will permit a Mist Router to promote the packet to the next hop, when hiding the original source and final destination.

To deal with the new challenges and issues in describing and administering security policies in pervasive computing environments, we recommend an innovative class of policies named dynamic policies.

We discover the nature of security promises that can be prepared about the system state before, during, and after the execution of dynamic policies. We consider that security problem need to be incorporated into models of system behavior, and security policies have to form an essential part of system provision.

This investigation is critical in the context of active places and in other dynamic surroundings where operational parameters are continuously varying.

Power Management

In case of mobile devices or computer devices the power consumption is a important issue. Also why energy factor issue arises in pervasive computing means they operate in a dynamically changing context [14]. This is in terms of both user needs as well as computational needs. Also this can be handled in the network communication and CPU processing of smart phones. But it is a bottleneck in terms of wide scale adoption of cloud based services. Because, more number of users needs different kind of information which is carried by several devices. In context aware system, the complexity arises due to the interaction gets increased between context consumers and providers. Hence to design software component for energy devices like those are somewhat difficult. Sometime it leads major impact, due to lack of important information in emergency case.

Even more modern energy devices found, researchers also addressed power overhead problem in context aware. For example mobile context broker method reduced the overall power consumption in both users and providers, it is only limited for particular user and particular parameters. So further we can enhance for set of devices as well as complex queries.

Issues of various factors in context aware

Factors Behavior and Issues

Context modeling, reasoning and recognition Comprehensive context modeling, reasoning and context prediction is handled by different approaches and improves the reliability and accuracy of context.

Conflict situation

Quality of context parameter is used to face the conflict situation. It improves the completeness of context, trustworthy, significance and up to date of context.

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Unexpected adaptation

Service-Oriented Architecture is dealt with unexpected situation. It handled the overhead communication problem.

Security and Privacy

This dealt with issues of security and privacy of users and computing devices. Reduced the issues significantly yet still a problem due to dynamic changes in context.

Power management

It suggests few solutions but it is not helpful during huge number of users and complex queries.

3. CONCLUSION

In the above literature survey major types of issues in pervasive computing are discussed. Issues are in terms of context modeling, reasoning, recognition, conflict situation, unexpected adaptation, security and privacy, and power management. Also some more factors are performance of context aware, algorithms and data structures and reliability issues. Ontology based approaches are helpful with dealing the context modeling and reasoning of context awareness.

It provides clear representation of context in pervasive computing [15]. Quality of context parameters describes that which is valuable information for particular application. This improves the performance and effectiveness of context aware systems. SOA can handle the decentralized approach and progress the scalability of context aware. Security and privacy of computing environments is increased by using few authentication schemes. Due to complex computing time and limited energy resources power consumption problem araised.

Finally we conclude that still some more new techniques needed to improve and enhance further developments of efficient context awareness in pervasive computing.

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