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The Scientific Information Exchange General Model at Digital Library Context: Internet of Things

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Abstract

Introduction: This paper aims to develop a Scientific Information Exchange General Model at Digital Library in Context of Internet of things, which would enable automated and efficient library services. To accomplish its objective, the main classes (Concepts), sub-classes, attributes are identified in order to introduce an appropriate model.

Methodology: The approach of this study is basic, exploratory, and developmental and is run through a mixed method consisting of documentary, Delphi, and data modeling methods. The study population in the documentary section includes the study of information resources retrieved in related subjects. The study population in the Delphi section is consist of 15 experts in “Internet of Things” and “digital library” domains. The Data gathering procedure is by applying a semi-structured interview. Appropriate software is applied for the analysis.

Results: The findings showed that the 9 main classes of “End user”, “librarian”, “Microcomputer”, “Digital library server”, “Automated information services”, “Physical resources”, “Virtual resources”, “Information resources on the digital library server (virtual object)”, and “Security” in general model of scientific information exchange are very contributive. In general, 27 sub-classes and 38 attributes are identified for the main classes for this purpose. In this model, how the classes communicate and interact with one another is illustrated to justify this theme.

Conclusion: Here it is deduced that focusing on data protection at two levels of user and server in the main class of security is very important. Focusing on information resources metadata in the entity class, and device to device communication in this model is of essence as well. This proposed model is contributive in information networking in Internet of things-based library systems in providing better services to users.

Research value: This model has potential in offering a basic proposal as a startup for automated library services.

Keywords: Internet of Things, Scientific Information Exchange, Information Networking, Digital Library, Data Modeling, Data Model, Virtual Object

Introduction

The Internet of Things is a new intriguing phenomenon that has made many researchers involved in academics and industry context. Here, real-world physical and virtual things become connected to the Internet. Because of the heterogeneous and distributed nature of things, it is difficult for them to integrate and interact with one another because they add more things to the Internet (Raiwani, 2013). The main drawback of Internet of things (IoT) is lack of integrity in things' description, and adding another platform makes this drawback even more acute. Consequently focus is on providing of platform; an abstract layer that accepts existing platforms. Focus relies on rich modeling standards (Smith, 2004). Therefore, devising a basis and common language for systems and the architecture of IoT is a must.

In this context, these models and standards need to be proposed and developed in various industrial and service enterprises and be adapted to their characteristics and requirements in a sense that in addition to incorporating the main concepts in the basic models of the IoT, like "existence", "resource", "service", and sometimes "device," other concepts are consistent within the specific requirements of the enterprises. Accordingly, this proposed model can be considered as the basis for the implementation of the Internet of objects in industry and service. For this purpose, digital libraries are no exception, where in order to take advantage of the benefits of information networking in the context of the IoT and their implementation, providing data models consistent with the service functions of these enterprises become essential. Scientific information exchange and information networking are among the important services provided through the digital libraries, where by adopting IoT becomes efficient and automated. Scientific information exchange is to facilitate communication among researchers at different points of digital library, and it constitutes the basis for scientific development. By adopting IoT in scientific information exchange system, the digital library facilitates access to scientific information, improves the quality of information exchange, and ultimately facilitates the exchange of data among digital libraries, the same true for users in an automated sense with no need for interpersonal involvement. The IoT can be regarded as an automated information network where all entities are capable of producing, transferring, and sharing their data. Applying such information networking in the digital library will result in automation, in addition to enhancing the quality of services.

The first step here is identifying the main classes and sub classes and the basic features of the model to provide a model for the scientific information exchange at digital library in IoT context. This step is followed by meeting the modeling techniques and methods' requirements. Data modeling (West, 2011) is one of these techniques for defining and analyzing data in information systems. The main restriction here is the absence of the manner in selecting the general model for scientific information exchange in a digital library through IoT. To provide this general model, the main and sub classes of the model should be identified. This necessitates the careful examination of the features of each one of these classes in the model; it is notable that this proposed model is not specific to a general or special digital library. In general, this proposed model provides the main concepts, sub-concepts, attributes and to a lesser extent, the correlations available in Scientific Information Exchange General Model at Digital Library in IoT context (SIEGMDLIoT). In order to accomplish this objective, the following specific questions are answered in this study:

1. What constitutes the main classes in SIEGMDLIoT?
2. What constitutes the sub classes in SIEGMDLIoT?
3. What constitutes the Features in SIEGMDLIoT?
4. What is a SIEGMDLIoT?

Literature review

There exit many applicable metadata models and standards for integrating and facilitating the connection of physical and virtual objects to one another. In 2010, Kortuem et al, proposed a non-functional metadata model, where, the smart object is categorized based on either of the following dimensions: design, activity-awareness, policy- awareness, and process- awareness. Such a classification is in program -oriented domain towards the design of smart objects and could be applied in IoT systems' development. Such collaboration is not functional, because it could only classify smart objects based on design aspects. Kawsar et al (2010) proposed a functional metadata model, with the purpose to manage the smart object through Profile Description Document (PDD) (including information about the smart object's tools and capabilities). In their model, the functional classification of the smart object is based on the two documents of Smart Object Description Document (SODD) and the Profile Description Document (PDD). This categorization is assigned to the implementation and management of the smart object supported by the FedNet middle ware and the basis for creating discovery services and smart object management systems. In 2011, Uckelmann et al, proposed a non-functional metadata model, where the smart object is categorized according to the developer (self-made, ready-made) and purpose (specific and open). Only the two aspects of (developer and objective) are considered in this classification and are not related to the cyberphysical features of smart objects. Therefore, such a classification cannot be applied in a functional manner in IoT systems. In 2011, Serbanati et al, proposed agnostic models of conceptual technology, as to extract smart object relations with the digital proxy Peer and its user by smart object model. In this model, the information of the smart object is available in the searchable resource registry. This model, with the concepts like accumulation of smart objects and the link between services and resources provides flexible guides for smart object modeling. In 2011, Pascual-Espada et al, introduced the resources managed by device programs model, which deals with the concepts that can be considered as virtual objects. In their model, the virtual objects consist of a numbers of records stored in a database. One of the drawbacks of this model in its ability in running virtual objects on different devices; of course these devices which want to display a virtual object should be equipped with a specific application that recognizes the specific format of the object. Another drawback, due to the previous one, is, if any program is only able to interpret a particular type of object, the devices need a large number of installed programs. In addition to the complexity, due to the development of an application for each type of virtual object, device and operating system, it would be inappropriate for each website to require a specific browser for interpretation. Pascual-Espada et al, (2011), proposed the model of resources managed by web applications, where the concepts that can be considered as virtual objects are of concern. In this model, virtual objects consist of records in the data warehouse, managed by web applications. In such systems, certain devices like automated teller machine (ATM), are directly linked to the management plan, are applied. Here, the object interpretation and management is not conditional on the client installed program because it is run through a web browser. This type of system is problematic when the virtual objects communicate with other applications outside, where they are run. There exit many web applications that provide APIs as web services for data stored in the Web application (model an object), which can be integrated applications. Although this alternative may be sufficient in some cases, this solution is far from ideal. There still exit problems with the connection of physical object and virtual object associated with the location-related services (supermarket, parking, etc.). Fortino et al (2013) proposed a metadata model for representing the functional and nonfunctional features of smart objects in a structured manner in order to index, discover, and select the dynamic smart object identified by the smart object model. The four main categories of the model include the type, device, service and location. This model is more general than the one proposed by Serbanati et al (2011) and is implemented in the discovery framework for indexing smart objects, dynamic discovery and selection. The IoT reference model was presented by Bauer et al (2013), the development of the basis and common language for systems and the architecture of the IoT is the objective of this model. This model is made up of sub-models of domain, information, function, communications, trust, security and privacy. Fortino et al (2014) presented the smart metadata model. The purpose of this model is to describe a smart object in every area of interest (like smart city, factory, home, grid, building, etc.). The eight categories of this metadata model consist of: status, fingerprint, physical features, service, device, user, and location of the constituent concepts of this metadata model. This metadata model revealed that the static parameters of the smart objects, while showing no relevant dynamic parameters. These parameters can be restored through the operation of the available services or from the smart object position (usually through the smart object positioning service). Yachir et al (2016), provided a comprehensive semantic model for describing and applying smart object solution in the IoT. The concepts of person, space or place, equipment, device, and service constitute the main concepts considered in this model. They considered concepts like person, device or equipment as entity. In this study, the concepts of person, equipment and device is located in the concept of a specific place and the concept of the device is the service provider. The equipment includes the device and is controlled by the device. They measured the effectiveness and applicability of their semantic model as a case study for smart environmental monitoring.

Summarizing the literature review

In general, in a study where data and metadata models a proposal, architectural models, IoT reference models of, or virtual object models or physical object models develop models in general, and no specific industry or applications were considered There exit cases where special use is of concern (like development of a virtual object model for movie tickets, or smart environmental monitoring). In general, the count of fundamental studies that provide a SIEGMDLIoT, in order to provide smartness to the library is rare. Any model would applySIEGMDLIoT next to applying a software, hardware and middleware, could be one step in advance towards its being implemented in the library, thus the objective of this study.

Method

The method adopted here is basic, exploratory, and developmental. This study is run through a combined method consisting of documentary, Delphi, and data modeling. Here, the Delphi method is applied to determine the main concepts, sub- concepts, and features of the general model regarding the theme, in order to implement the IoT in library systems. The documentary method is applied to prepare Delphi's first round interview form, the basis of this study. The research community in the documentary study consists of: study of information resources retrieved in IoT, Scientific Information Exchange, Information Networking, Digital Library, Data Model and Virtual and physical Object subjects. Sampling method in the documentary involves studying the related resources. The research community the Delphi panel consists of 15 experts who form the Delphi panel members in the "IoT" and "digital library" domains. The sample is selected in the Delphi qualitative section through Purposeful sampling. The data gathering tool is the semi-structured interview. According to the research objectives, SPSS software is applied in analyzing the results of three rounds of run Delphi process. After reviewing the information resources and extracting the main concepts, sub concepts and attributes, the first Delphi interview form is designed. The members of the Delphi panel came up with consensus and finalization in relation to the main concepts, sub concepts, and attributes in three phases. By applying a data modeling method, a basic model is devised for the scientific information exchange. Data modeling is the process of devising a data model for an information system by applying specific formal techniques. This data model provides a framework for data, applicable in information systems by providing a specific definition and format"(Simsion & Witt, 2004). By applying Protégé's software and data modeling method, this model is designed.

Results

The obtained findings here are based on research questions in the following four sections containing: the main concepts, sub-concepts, attributes/features, and SIEGMDLIoT.

The main classes in a Scientific Information Exchange General Model at Digital Library in context of Internet of things

The 9 main concepts regarding SIEGMDLIoT are tabulated in table 1, where the position of each concept is determined in the IoT architecture layers.

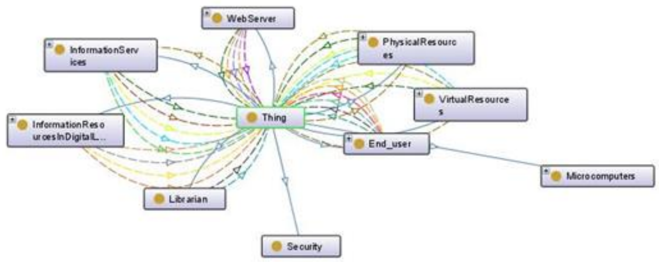

Figure 1. Main classes in a Scientific Information Exchange General Model

As observed in figure 1, the main 9 classes of: End-user, librarians, microcomputer, digital library servers, automated information services, physical resources, virtual resources, information resources on digital library server, and security are the main concepts regarding this them.

Table 1. Main classes in a Scientific Information Exchange General Model

General main concepts	**General main concepts defined in digital library**	**Position of each concept in the IoT architecture layers**
User	End User	Management Layer
	Librarian	
Device	Microcomputers	Management Layer; Application Layer; Network Layer
	Digital Library webserver	Management Layer; Network Layer
Service	Automated Information Services	Management Layer; Network Layer; Service Layer; Final application Layer
Resource	Physical Resources	Management Layer
	Digital Resources	
Entity	Information Resources on Digital Library web server	Management Layer
Security	Security	Management Layer

As observed in table 1, all concepts are located in the management layer, the device (microcomputer), the digital library server and the automated information services are located on the network layer, the microcomputer is in the application layer, and the automated information services are in the service and the final application layer.

The sub classes in a Scientific Information Exchange General Model at Digital Library in context of IoT

The results obtained from the views and comments of the members of the Delphi Panel on sub-classes are tabulated in table 2 and figure 2.

Table 2. Sub classes in a Scientific Information Exchange General Model

Main concepts	Sub concept
End User	Normal users
	Users with specific features
	Users with specific needs
Librarian	-
Microcomputers	Desktop Computer
	Laptop - Notebook Computer
	PDA
Digital Library Server	Information storage and increasing server power and speed devices
Automated Information Services	Authentication and user profile control
	automated Data retrieval
	Automated Data access
	Automated Data sharing
Physical Resources	Memory
	CPU
	Network bandwidth
	Energy
	Used Device
	Data Repository
	Security
	Reid system
Virtual Resources	plugin
	Access permissions Copyright
	Platforms that fit different groups of users
	UI graphical features
Information Resources on Digital Library web server	Book
	All non-book document
Security	Microcomputers-level security
	Server-level security

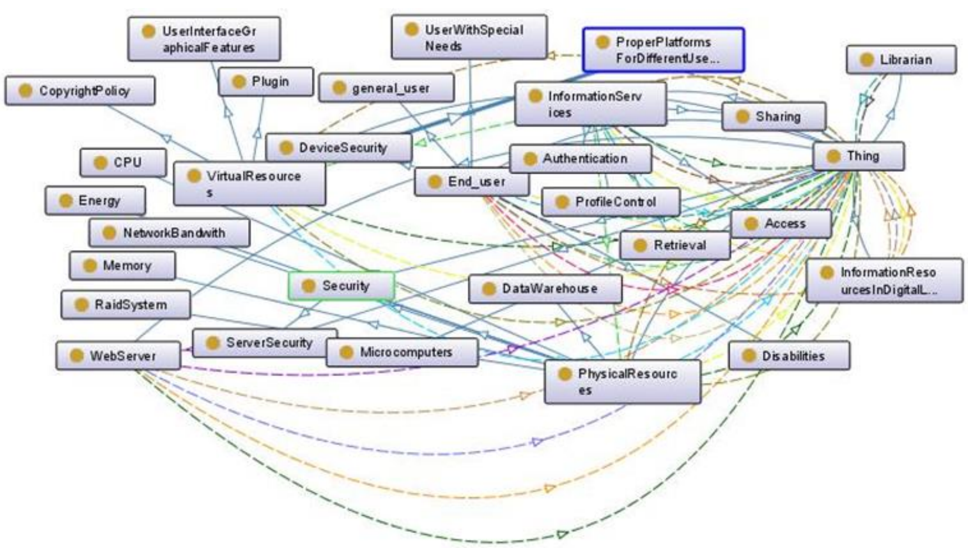

Figure 2. Classes in a Scientific Information Exchange General Model

Features in a Scientific Information Exchange General Model at Digital Library in context of Internet of things

Table 3 observed the attributes defined for the main and sub classes. For each of the main concepts, it can be considered depending on the need for some features. This table lists some of the most important features.

Table 3. Features in a Scientific Information Exchange General Model

main concepts		sub concept
End User	User Profile	Name
		Last Name
		Id Number
		Sex
		Age
		Degree(Field of Study, Grade)
		Job
		Research and study interests
		How to contact the library (contact number, email address, telegram, etc.)
		Type of document required (book, article, film, conference and seminar, audio file, government report, patent, laws and regulations, other information sources)
		Information resources used by the user (Information resources and organizations referenced)
Librarian		-
Microcomputers/ Digital Library Server		Device Profile
		Status
		Identifier
		Type
		Service Quality
		Creator
Automated Information Services		Name
		Type
		Service Quality
		Authentication factors
		Time and Location Features
		Value
		Access Mechanism(library is the owner of Information Resource or not)
		Free or cost-effective
Physical Resources/ virtual Resources		Name
		Type
		Time and Location Features
		External metadata and link to them
Information Resources on Digital Library web server		Name
		File Type
		Identifier
		External metadata and their links
		Information source specifications and Summary
Security		Accuracy
		Privacy
		Access control
		Authentication

Scientific Information Exchange General Model at Digital Library in context of IoT

To design SIEGMDLIoT, based on the main concepts, sub-concepts and extracted attributes, and their relationships, applying the Protégé 5.2 software, which is a tool that can devise ontology and define classes, data properties, objects, instances, relationships, etc. (Tudorache et al, 2013). The reason for applying this software is to allow the model clearly illustrate the main concepts, sub-concepts, attributes and relationships, figure 3 shows some relationships include accesses, device-to-device communication, are attached to, are part of, Manage process, use device application on, has container, and has function.

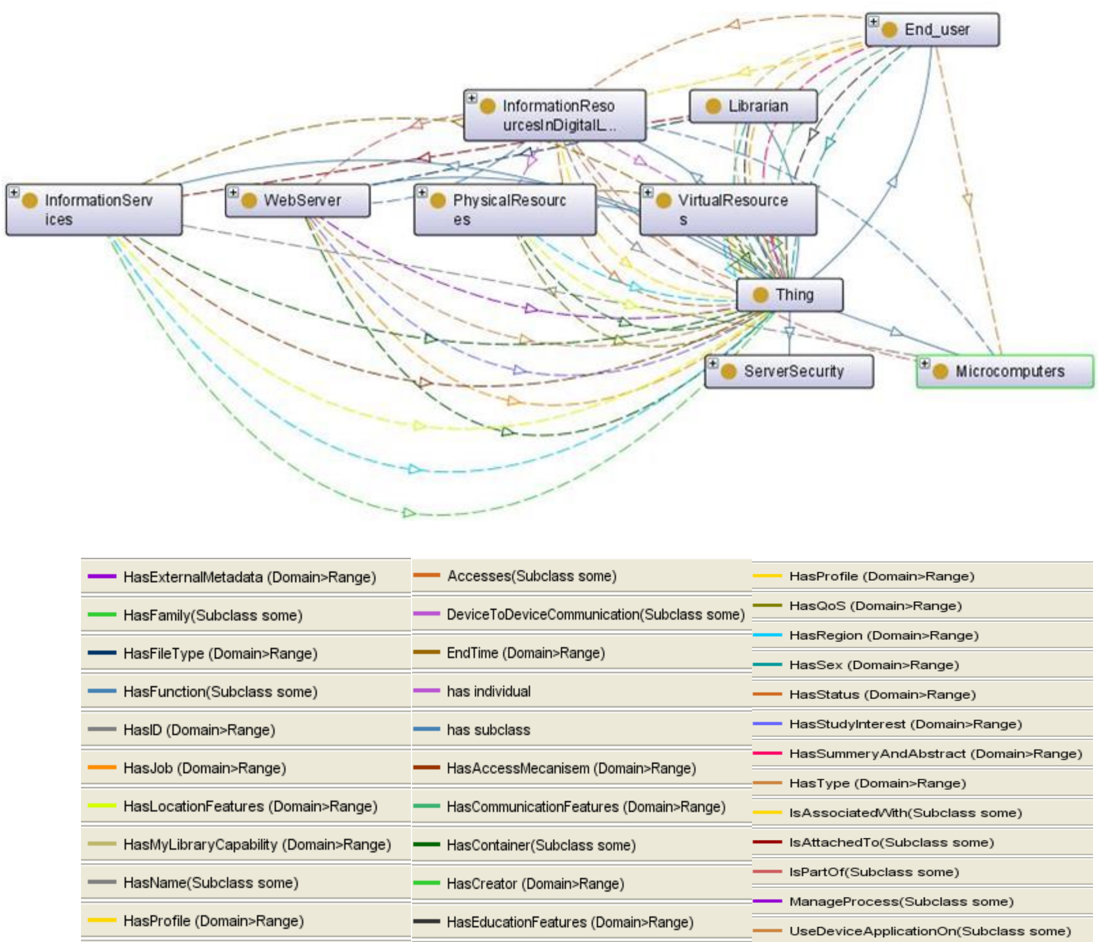

Figure 3. Scientific Information Exchange General Model at Digital Library in context of IoT

A simple schema of the Scientific Information Exchange General Model at Digital Library in context of IoT is shown in figure 4.

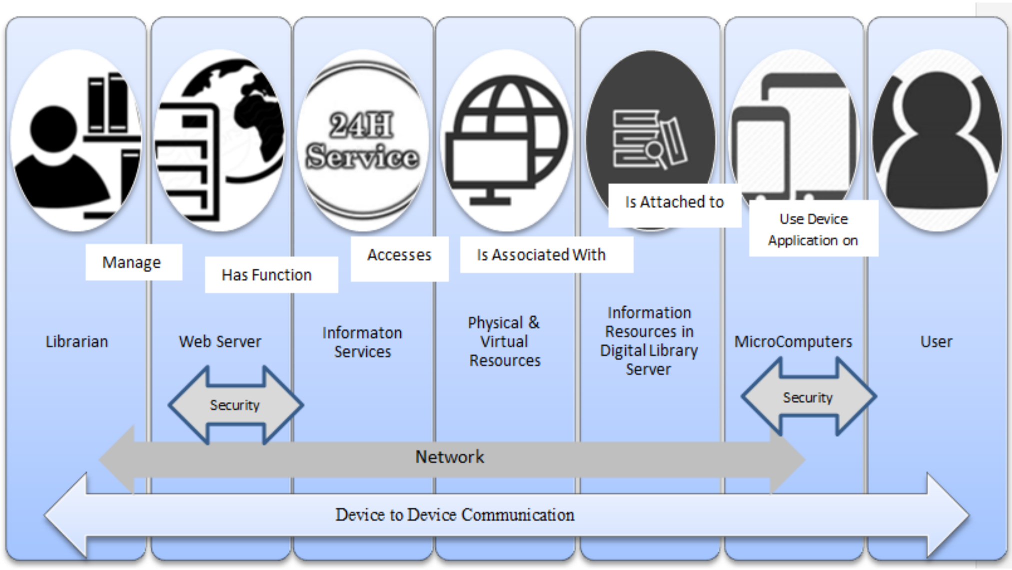

Figure 4. Scientific Information Exchange General Model at Digital Library in context of IoT

Model Interpretation

In general, the scientific information exchange at digital library in context of IoT begins with the activity of digital librarian in three parts of: 1)librarian management in preparing and delivering information resources to the user, 2)managing information resources security issues and 3)and controlling dissemination and access in accordance with copyright laws, and managing and consulting on the structure and requirements of the user interface of the application used in the user's microcomputer. The first two parts are on the digital library server and the third is on the microcomputer. In the next step, the digital library server is considered as a device in the IoT topic. The server has a function called are named provision of information services, possible in the network context. At the two ends of this network, there exist the two devices of server and microcomputer; connected to each other, based on IoT communications protocols, therefore, it is possible to provide automated services. The information service is the next concept, for which there must be access among this concept and the physical and virtual resource concept. The most basic physical resource is the network where scientific information exchange is within its context. The access and relation of service with resources like memory, network bandwidth, security, Raid system, copyright policy, platforms, and graphical user interface features are of efficiency. Physical and virtual resources with virtual entity or information resources on the digital library server are in contact as well. Information resources are connected to the device. Here, it can be claimed that the device (server and microcomputer) acts as a container for information resources. The end user can access the information resources with the assistance of his microcomputer application.

Discussion and Conclusion

Majority of the members of the Delphi panel believe that the 9 concepts involved here constitute the essential elements in materializing this theme. In this study, the entity is considered as a virtual thing (virtual information resources); In addition to research focused on physical entities; it can also be compared with research that considers the virtual things as an entity. In most studies, the three main concepts of entity, service and resource are considered as the main concepts of the service model in the context of the IoT; while, in some, the necessity of the device is referred to as one of the main concept. In this context, De et al (2011) referred to the four entity, resource, device and service as the main concepts of the information model of the IoT. In a study run on Service Modeling for the IoT; and in the OWLS service ontology, for the domain model, the three main concepts of entity, resource, and service are considered as the main concepts. To Pascual-Espada et al (2011) the concepts of entity ((virtual object) such as cinema tickets), resource, device, and service are considered as the main concepts. To Fornito et al (2013) type, device, service, and location are considered as the main concepts. Fortino et al (2014), considered the eight concepts of status, fingerprints, physical characteristics, service, device, user and location are considered as the main concepts together with a physical library for model testing. Yachir et al (2016) considered the concepts of person, space or place, equipment, device and service are as the main concepts. In their study, they considered concepts such as person, device or equipment as entity. In this study, the concepts of person, equipment and device are in the concept of a specific place and the concept of the device is the service provider. The device is devised by a person. The device is in the equipment and controlled by the device. They measured the effectiveness and applicability of their semantic model as a case study for intelligent environmental monitoring. Based on the obtained results, each one of the 9 main concepts includes sub-concepts in the scientific information exchange model in the IoT context. The normal users, users with specific features and users with specific needs are considered as part of the user's sub-concepts in this model. The need to consider these sub concepts for the end user concept is due to the change of user interface, hardware and software requirements different from those of each user group. These features of the user must be specified in the user profile. Consequently, it is possible to provide automatic service to the user according to his or her conditions. It should be noted that one of the target groups in the IoT is the disabled. In this context, by living and working in intelligent environments, this group of individuals if resort to IoT will be able to independently carry out their daily activities. The field of scientific information exchange and seeks information and isno exception, that is, these individuals will be able to independently and with providing their profile to information systems in the context of the IoT with sharing information in an easy manner. The other category of sub-concepts in this model is related to the device. Devices like Desktop Computer, Laptop - Notebook Computer, PDA on one hand, and data storage and increasing the server's power and speed devices, on the other, can be considered among the device's sub concepts. The need to consider the device applied by the user as a sub concept, is the adaptation of the program and software used in the IoT in terms of user interface, software volume, etc. with the user's device. To illustrate this, for example, whether in the IoT system of the library, software designed and available for the intelligent object and the IoT like openHAB and their extension, or from software designed in the field of libraries like caliber and expansion They are applied in accordance with smart object models and the IoT; The ability to load and run such software on any device used by the user is of major concern. Focusing on to storage devices as a sub concept of a server is essential in IoT system’s response speed as to the automated service. The count and type of server storage devices are one of the factors that increase the speed. Other categories of sub concepts in the model are service-related. One of the basic objectives of IoT systems is to provide timely, efficient and automatic service. Where applying scientific information exchange system on the context of IoT sub services like automated authentication and control of user's profiles, retrieval, access and sharing are based on user profiles. After verification and authentication, users can share their electronic resources available on their microcomputers with their academic colleagues through Bluetooth, WiFi or other protocols, where the function in two modes of notification and execution are justified. This function has an input, (i.e., identifier of an information resource) and an output (i.e. an existing resource of information). In this process, automatic search is carried out in the information resource database by applying the identifier. The process is such that at first the automatic search in the information resources database is run through the identifier. If an information resource is found, the user will be notified (who would download it if needed) or download the information resource directly. When that there is no information resource a correct answer is sent to the user. The other sub concept categories are related to the physical and virtual resources. The most basic physical resource is the network handling scientific information exchange in its context. Access and relation of service with other resources like memory, network bandwidth, security, Raid system, copyright policy, platforms, and graphical user interface features will be of service efficiency. Plugin, access permissions Copyright, Platforms that fit different groups of users and UI graphical features constitute the virtual resources sub-concepts. The other groups of sub-concepts are related to entity. Which include the book and all non-book documents. Here the virtual object or entity is an electronic information resource that its owner of which is changed, exchanged, stored in the library server, retrieved and transferred. The other group is the sub concepts of security and data protection at the microcomputer level and the digital library server. In general, data protection is divided into two levels of information resources and user information protection. This security must be applied to, virtual entity, resource, and service layers of the device. At the information resource protection level , all the data protection on the server (device)), providing backup files, using security permissions like file level and sharing levels, protecting files and documents using a password and protecting data in transit (entity)), secure transmission in local, global, Internet and intranet, network access security, data security (network-level data flow), host security, application security (resource), Identification, authentication, encrypting the digital library server, cloud computing, social networking etc., retrieval, delivery (server / user database) (according to Copyright law, demographic information, etc.), access control (service) must be applied. At this level all the identification, licensing, encryption of the digital library server, cloud computing and social networking etc.; retrieval, delivery (server / user- database) (based on copyright law, demographic information, etc., control Access (service); data security (network-level data flow)(resource); secure application (device); authentication and control of user profiles; sharing (user-user) (archiving policy, etc.) (Service) must be applied.

For each one of the main concepts, upon need, some features must be of concern. The user is introduced and known using the defined attributes for the system. A profile is developed for the user by attributes. The concept of a profile in the Scientific Information Exchange General Model at Digital Library in IoT is essential, because an important part of automation is based on the data and values available in the profile. Here the system recognizes its information needs by checking the user profile and performs the appropriate function on the appropriate information resource thereof. The microcomputer and the library server should have a well described definite time and space setting.

Each device needs an identifier in order to be identified in the system. Each device has a special type of creator that is considered to be the key to describing that device. The service quality parameter describes the quality of service provided by the device. The concept of service also has features. As to access permission factors, it should be noted that it is an important feature of a service. Because the levels of access to the service must be specified for different users the information contained in the system is protected. Given that the library is the owner of the information resource whether served or not, there exist different access mechanisms. Whether the information resource is in a form of a full text or a summary and abstract, is relevant to this feature. As to resource attributes, it should be noted that resources in IoT model should be described in order to determine, whether they are networks, storage spaces etc. One of the attributes for the entity concept is the file type, including: PDF, Epub, Zipped / unzipped, HTML, Mobipocket, Microsoft Office Word Doc / DocX, Microsoft Compiled HTML / CHM files, Plain text files, also known as ASCII text files. External metadata and the linkage thereof refers to the metadata needed to describe the information resources and the ontologies needed to describe some of the specific features that should be added to the system. In order to explain the proposed model based on the IoT reference model, by Bauer et al (2013), the abstract sub-models including domain, information, communication, functionality, and security for proposed model must be of concern. As to the sub-model of the domain in the Scientific Information Exchange General Model at Digital Library in IoT context, the basic concepts of the end-user, the librarian, the microcomputer, the digital library server, the automated information services, the physical resources, the virtual resources, the information resources on the digital library server and the security are considered. In the proposed model, these concepts are linked together in a chained manner. By incorporating information resources and user profiles the library server is a function named information service. This service is based on microcomputer; that is, receiving service in an automated manner which would allow the user to make some decisions about the service. For example, if a notification is sent to microcomputer application user about downloading an information resource in accordance with his/her profile and information needs, he/ she can decide whether or not to download it. Or if it is downloaded in one step and there is no notifications he/she; can decide on reading or sending and sharing it with colleagues or others. This process is forstoring the information object on the server, protecting it, sending and providing service in the context of the network and receiving it by a microcomputer, depending on resources. In this process, a set of physical and virtual resources are contributive. These resources on the server include memory, CPU, data storage devices, energy, copyrights and permissions access, Raid systems etc., upon need and in microcomputers include memory and platforms that fit different groups of users, graphical user interface features etc., upon need. The service process includes resources like network bandwidth, plug-ins, processes required for service, and more dependency on the need. In this model, what is important about the target entity or information object or information resource is its connection to the specific metadata required by the entity. In this model, an entity is an information resource, thus, it is necessary for it to be linked to one of the Dublin Core, z39.50 metadata and the like, according to the metadata system of the information resources in the digital library. It should be noted that these metadata are considered as complementary metadata essential in Scientific Information Exchange General Model at Digital Library in IoT context. In addition to metadata, it may be necessary to apply different ontologies to describe different features of the main and sub-concepts. In this model, data protection in two parts is intended including of the server to protect information resources and in some extent user information protection and in the microcomputer to protect information of user profiles In general, in IoT, the debate on security is an important topic, specially here, where the objective of focus is on information resources and libraries. Because in relation to information resources, and especially electronic information sources, the copyright debate and copyright protection and control of user access levels, the monitoring of access mechanisms (may be the library is the information resource or not), the cost of receiving the work (which is in The model of the IoT can be considered as an attribute called value), is fundamental issues. In general, object communication protocols, in the IoT are divided into three categories of devices to devices, devices to cloud and devices to gateway. In this study, the communication protocol is device to device. In this model, the two devices of digital library server and user device are combined to each other to provide automated information services. In this study, the two layers of management and application prevail. The application layer refers to an application where the user can apply in the context of IoT to get the necessary services. The management layer is throughout the current process. Perhaps the two layers of management and application can be mentioned as the main concepts in this model, classes of which would be defined subsequently.

This model can be a basis for future studies in this context. Given that this model is based on the services of the digital library, has a general view, researches with a Minority view, the IoT Model for each activity of library at two levels of information resources and physical and virtual equipment. The implementation of this model be clarified as an applied application of defects and its weaknesses.

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