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A UML Framework for Socially Responsive Resource Usage Protocol

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Abstract- Everything available in our environment which can be used to satisfy our needs, provided, it is technologically accessible, economically feasible and culturally acceptable can be termed as 'Resource'. Therefore, planning is essentially required for judicious use of resources. It has importance in a country like India, which has enormous diversity in the availability of resources. This calls for balanced resource planning at the national, state, regional and local levels. This paper shows a UML framework for the implementation of the Socially Responsive Resource Usage Protocol with a case study. It deals with the issues involved in the design of the protocol, the way in which the protocol was built to address the needs of both users and resources with the prime aim of protecting both user and resource rights.

Keywords: *Class Diagram, Collaboration Diagram, Interaction Diagram, Resource and Sequence Diagram.*

I. INTRODUCTION

Everything available in our environment which can be used to satisfy our needs, provided, it is technologically accessible, economically feasible and culturally acceptable can be termed as 'Resource'. Therefore resource is any physical or virtual entity of limited availability that needs to be consumed to obtain a benefit from it. The process of transformation of things available in our environment involves an inter-dependent relationship between nature, technology and institutions to accelerate their economic development. In most cases, commercial or even non-commercial factors require resource allocation through resource management.

Resources empower an individual to sustain and excel. Resources are either natural or man-made. An increasing global population needs more resources. Economic development is sought by societies not only to satisfy basic material needs, but also to provide the resources to improve the quality of life in other directions, meeting the demand for health care, education and a good environment. Sharing of state

resources like natural resources and developmental funds needs to be inclusive as well as traceable. In developing countries, poverty eradication program is mainly prescriptive and follow top-down approach. However, the current trend has taken bottom-up approach. Well-informed individuals and self-help groups have started taking decisive roles for self-development and poverty eradication.

A. Development of Resources

Resources are vital for human survival as well as for maintaining the quality of life.

It was believed that resources are free gifts of nature. As a result, human beings used them indiscriminately and this has led to the following major problems

- Depletion of resources for satisfying the greed of few individuals
- Accumulation of resources in few hands, which, in turn, divided the society into two segments i.e. have and have not's or rich and poor.
- Indiscriminate exploitation of resources has led to global ecological crises.

An equitable distribution of resources has become essential for a sustained quality of life and global peace. Therefore, resource planning is essential for sustainable existence of all forms of life. Sustainable existence is a component of sustainable development.

B. Resource Planning

Planning is the widely accepted strategy for judicious use of resources. It has importance in a country like India, which has enormous diversity in the availability of resources. This calls for balanced resource planning at the national, state, regional and local levels. Resource planning is a complex process which involves:-

- Identification and inventory of resources across the region. This involves surveying, mapping and qualitative and quantitative estimation and measurement of resources.
- Evolving a planning structure endowed with appropriate technology, skill and institutional set up for implementing resource development plans.
- Matching the resource development plans with overall national development plans.

The availability of resources is a necessary condition for the development of any region, but mere availability of resources in the absence of corresponding changes in technology and institutions may hinder the development. Here, we are mainly concerned of fair distribution of public resources like state funds and natural resources that are usually used for poverty elevation, personal uses and business purposes. This paper proposes a resource usage protocol with prime aim of protecting both user and resource rights. User rights include fair chance of resource usage whereas resource rights include protection and conservation of resources. The proposed protocol presents a framework for communication among users and resources (i.e. agencies managing resources).

The proposed protocol is useful for orderly usages of natural resources and public resources like coal and house building aid respectively. In general these resources are managed by designated agencies; a user interacts with it for availing a resource. The novelty of the proposed protocol includes:-

- A generic framework for public resource management.
- Assurance of fair order to access resources promoting social inclusion.
- Ensuring protection of resource rights.
- Traceability of resource usages.

The paper has another five sections. The second section presents a possible solution having resource usage protocol. In third section, the entities and their relations used in design of the protocol are specified in class & interaction diagrams, alongwith the protocol stack and its behavior are modeled. A case study is carried out in the fourth section. Fifth section concludes the paper.

II. RESOURCE USAGE PROTOCOL

The protocol is designed to address today's social concern like resource sustainability, transparency in resource usages and achieving social inclusion providing priority to socially deprived people. A

socially disadvantaged person needs resources mainly for survival whereas a user with knowledge and capital needs resources for commercial usages; thus making profit for personal growth. Rights and privileges are to be associated with constraints particularly when natural and public resources are in use. A resource usage is viewed as a process that starts from initiation of resource request to fulfilling of obligation for resource usage before the process terminates. That way, a resource usage session has a life time spanning from initiation to termination. During the session, both user privileges and resource rights are guarded by checking the satisfiability of constraints and obligations. Resource constraints follow just enough principle to safeguard resources from unabated exploitation. It also follows just fair principle that prioritized under-privileged users based on their social distances. Social distance is a notion that quantifies how far a person is from a resource. More the distance, the more the person is at disadvantage to assess the resource. A worldwide concern on food supply chain includes sustainability as well as transparency. Sustainability addresses wider global issues like environmental as well as social issues. Every citizen has right of access to state resources and at the same time each resource primarily natural resources also have right to protect themselves from misuse as well as overuse. A resource is described in a way so that its social roles and responsibilities can be specified and queried.

III. PROTOCOL STACK

The salient features of the protocol are enlisted here :-

- A user and a resource exchange messages between them during a resource usage session. Resource usage is a process initiated by a user and in between resource and user both the routers *ur* and *res* take part in message communication.
- Both the routers validate, prioritize, route and record messages transacted in resource usage sessions. A *ur* at a time or periodically or asynchronously collects a *ResourceRequest* and validates for onward processing stored in *ReqValidateDB* else, the request is rejected and the user is informed of the termination of the session.
- The validated requests are prioritized based on users social distances and stored in *ReqPriorityDB* and routed to a resource router *res* corresponding to the resource. For that, *ur* needs to have resource addresses.
- For each request *ur*, creates a session and logs the session related activities in different databases till the session terminates. A session on resource usage terminates for one of the reasons: on rejection, on resource delivery and meeting resource obligation by the concerned user.

- It prioritizes the requests received from different user routers and updates it in the *ReqPriorityDB* and then issues the resources to each eligible request in turn.
- A user on receiving the desired resource should oblige to specified resource usage obligations.
- And compliance to such obligation is recorded both at *res* and *ur* associated to a transaction.
- And then the protocol terminates and the status is recorded at both the routers with respect to the resource.

For getting more insight of the protocol, references can be made to the works of *Socially Responsive Resource Usage: A Protocol* by *Hrushikesh Mohanty*.

IV. AN UML MODEL WITH THE CASE STUDY

The Unified Modeling Language is a standard modeling language with a rich graphical notation, and comprehensive set of diagrams and elements. The UML defines 9 kinds of diagrams, to help in the construction, analysis and comprehension of object-oriented programs. Of those diagrams, this paper focuses on two important kind: *class* and *object-interaction diagrams*. Class diagrams give the *static* view of how classes relate to each other. Object-interaction diagrams give the *dynamic* view of how a program organizes the interaction of instances of these classes to perform specific functions. The paper shows the UML framework for the implementation of the *Socially Responsive Resource Usage Protocol*. To better explain the UML model consider an example of Indira Awaas Yojana (IAY), a resource available for marginalized people. With a view to meet the housing needs of the rural poor, IAY was launched in May 1985. The Yojana aims at helping rural people below the poverty line belonging to SCs/STs, freed bonded laborers and non SC/ST categories in construction of dwelling units and up gradation of existing unserviceable kutch houses by providing grant-in-aid. The fund is available for those who have less than fifty thousand rupees annual income *AnnIncomeL5()* and should not have more than two acre of agricultural land *AgriLand2()*. A user is specified by its geographic location, the amount it can invest and some other facts which might be required by the concerned authorities. First the users submit their details either directly to the Block Development Officer (BDO) or to the Ward Member who forwards it to the Sarpanch which in turn submits it to the BDO. BDO which collects resource requests from users and keeps track of the delivery of resources to users, here acts as the *User_Router*. The BDO validates for onward processing else, rejects the request and informs the user of the termination of the session. A user can be prohibited to

use a resource either based on own social status or on performance history. The validated requests are stored in the *ReqValidateDB*. The validated requests are prioritized based on users social distances. Social distance between a user and a resource is computed by

$$SD_u^r = w_1 * LD_u^r + w_2 * ID_u^r + w_3 * CD_u^r \quad (1)$$

where LD_u^r , ID_u^r and CD_u^r correspond to location distance, invest distance and condition distance respectively for resource r and user u . Then the prioritized requests are submitted to the District Collector which acts as the *Resource_Router* corresponding to the resource. Unless the user satisfies obligatory conditions, the session remains active and used for filtering out further requests if any from the same user. The *Resource_Router* on receiving a request performs the same operations as the *User_Router*. It then prioritizes the requests received from the *User_Router* and issues the resources to each eligible request in turn. Finally the beneficiary on receiving the desired resource obliges to the specified resource. On availing the fund, an user needs to submit a house completion certificate *CompletionCert()*.

A. Class Diagram

The *class diagram* of the HBF system is shown in the Fig 1 using UML notation. Classes are depicted as boxes with three sections, the top one indicates the name of the class, the middle one lists the attributes of the class, and the third one lists the methods. An association is a structural relationship that specifies that objects of one thing are connected to the objects of another. Graphically, an association is rendered as a solid line connecting the same or different classes. A dependency is a relationship that states that a change in specification of one thing may affect another thing that uses it, but not necessarily the reverse. Graphically, a dependency is rendered as a dashed directed line, directed to the thing being depended on. Therefore the class *User_Router* is depended on the classes *ResValidateDB*, *ResPriorityDB* and *ResourceReq* which in turn is associated with the *User* class which provides all the required details of the interested users. The *Resource_Router* is associated with *User_Router* and *Resource* class, but depends on *ResPriorityDB*. In association, it's important to state how many objects may be connected across an instance of a relationship. This "how many" is called the multiplicity of a relationship's role and is written as an expression that evaluates to a range of values, with * representing "any number of objects". The visibility of the classifier's attributes and operation is represented by the symbols +, #, - which denote *public*, *protected* and *private* respectively.

- public :-Any outside classifier with visibility to the given classifier can use the feature; represented by the symbol +
- protected :-Any descendant of the classifier can use the feature ; represented by the symbol #
- private :-Only the classifier itself can use the feature ;represented by the symbol –

Figure 1 : Class Diagram

A. Interaction Diagram

An *interaction diagram* shows an interaction, consisting of a set of objects and their relationships, including the messages that can be dispatched among them. An interaction diagram is of two types –*Sequence diagram* and *Collaboration diagram*. A sequence diagram is an interaction diagram that emphasizes the time ordering of messages. Graphically, a sequence diagram is a table that shows objects arranged along the X- axis and messages, ordered in increasing time along the Y-axis. A collaboration diagram is an interaction diagram that emphasizes the structural organization of the objects that send and receive messages. Graphically, a collaboration diagram is a collection of vertices and arcs.

The Fig 2 shows the sequence diagram of the HBF fund. Firstly, there is the object lifeline. An object lifeline is the vertical dashed line that represents the existence of an object over a period of time. Most objects that appear in an interaction diagram will be in existence for the duration of the interaction, so these objects are all aligned at the top of the diagram, with their lifelines the top of the diagram to the bottom. In the offset *User_Router* first gets connected to the

database of the system through *dbConnection* and then collects all resource requests from the users via. *ResourceRequest* and *User*. The *Resource_Router* also performs the same operations as the *User_Router* while staying connected the database.

Figure 2 : Sequence diagram

The Fig 3 shows the collaboration diagram for the above example. A collaboration diagram is formed by first placing the objects that participate in the interaction as the vertices in a graph. Next, render the links that connect these objects as the arcs of these graphs. Finally, adorn these links with the messages that an object sends and receives. This gives a clear visual cue to the flow of control in the context of the structural organization of objects that collaborate. Collaborations diagrams have two features that distinguish them from sequence diagrams. First, there is a path to indicate how one object is linked to another. Second, there is a sequence number to indicate the time order of a message. The procedure that is followed for the sequence diagram is same for the collaboration diagram too.

Figure 3 : Collaboration Diagram

V. CONCLUSION

A successful software system is one that consistently deploys quality software that meets the needs of its users. Modeling is a central part of all the central activities that lead up to the deployment of good software. Therefore UML is not a visual programming language, but its models can be directly connected to a variety of programming languages. The protocol discussed here is designed for resource usages with sustainability and achieving social inclusion, with the prime aim of protecting user and resource rights.. Rights and privileges are to be associated with constraints particularly when natural and public resources are in use. The working of the protocol is graphically explained with the help of class and interaction diagrams. The class diagrams address the static design view of the system where as interaction diagram address the dynamic aspect of the system.

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